ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVI. No. 3. CHICAGO, SATURDAY, JANUARY 15, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SEAVER.

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
Tungsten Lamps in Automobile Service 121
Cost of Power in Three Central Stations 122
Electric Railway, Operating Conditions Improving in Massachusetts 123
Continuous Work in Line Construction 123
Northwestern Cedermans' Association Convention 124
Curing Arterio-Sclerosis by High-Frequency Currents 124
Sterling Electrical Manufacturing Sales Convention 124
Bernard E. Sunny 125
Growth of Gas-Producer Power Plants 125
The Chicago Electrical Show 126
Lighting of Broadway, New York City 128
Restrictive Recommendations for Massachusetts Public-Utility Companies 128
Chicago Eelctric Club 129
Joint Meeting of Engineering Societies at Boston 129
Annual Meeting of Wisconsin Electrical Association 129
Seebach-Wettingen 15,000-volt Railway 131
Proposed Electrification of Boston Terminals 131
Programme of 1910 Convention of International Street & Interurban Railway Association 132
Electricity Probable for Locomotive Headlights 133
CENTRAL STATION PRACTICE:
Power House Economies in Baltimore 134
Central Stations for Towns of 1,000 or 1,200 Inhabitants 136
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Saving Operating Expenses by Long Burning Flaming Arc Lamps. 139
Criticism of the Flicker Photometer 139
Tantalum Lamps for the Lighting of Ships 139
White Light from the Mercury Arc and its Complementary 141
TELEGRAPHY, TELEPHONY AND WIRELESS:
The Thorne-Baker System of Telantography 143
New Wireless Station in Germany 143
An Experimental Method of Efficiency Determination of Wireless Plants 144
Portable Wireless Outfit Receives Without Aerial 144
Proposed Wireless Control of the Seas 145
A New Wireless Telegraph Receiver 145
First Wireless Message Between Baltimore and Chicago 145
INDUSTRIAL POWER:
Electrically-Driven Pumps. II 146
Pumping Practice in the United States 148
Some Remarks on Electric Motor Drive 148
Electric Heating and Ventilation 149
Railroad Switching by Electricity 149
QUESTIONS AND ANSWERS 150
BOOK REVIEWS 151
Automatic Fire Alarm 152
Standardization of Rubber Material for Insulated Conductor 152
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 153
INDUSTRIAL SECTION:
The Visalia Fifteen-Cycle Railway 154
Pipe Mounting Disconnecting Switches 155
Universal Pipe-Bending Machine 156
The Elmo Electrically-Driven Washing Machine 156
The Hutchison Electrical Tachometer 157
The Induction Motor and the Four-Frame Textile Mill Drive 158
CURRENT ELECTRICAL NEWS 159
RECORD OF ELECTRICAL PATENTS 166

Copyright 1910, by Electrical Review Publishing Company.

TUNGSTEN LAMPS IN AUTOMOBILE SERVICE.

Recent applications of the tungsten lamp in automobile service illustrate the effectiveness of improved filament efficiency in displacing oil and gas illuminating equipment. Nowhere has the convenience of the incandescent lamp been more appreciated than in the field of automobile operation, and its superior safety and great simplicity challenge the competition of all lighting systems depending upon combustion for their successful operation. The use of low voltages in and around motor cars enables tungsten lamps with relatively short and thick filaments to be installed, and there is little or no difficulty in resisting the jar and vibration of the vehicle. Under the most favorable conditions automobile service imposes severe strains upon the oil wick and the feeding system, and the regulation of flow both in oil and gas systems not seldom has to be adjusted. The elimination of inflammable material and supplies from a machine is a step toward reduced fire risk no less than a gain in simplicity, and anything which will even in a small degree decrease the complications of the modern gasoline car is worth much to the automobile owner and operator.

The high efficiency of the tungsten filament enables a battery of moderate capacity to be used in the supply of current for lighting, where the old carbon lamp would be practically prohibitive. In a standard equipment of two twenty-candlepower headlights, two two-candlepower side lights and one two-candlepower tail light a 100-ampere-hour storage battery will supply these lamps continuously for twelve hours without re-charging. The life of the lamps and the capacity of the battery can be increased considerably in effect by cutting off the headlights when running in the towns and cities, and the ease of control is so great in comparison with that of gas or oil, that there is no tendency to leave the lamps burning when not needed, to escape the trouble of adjusting them. The use of four, six or eight-volt lamps enables the equipment to be installed in connection with the ignition battery service.

To secure the best results with low-voltage tungsten lamps on a car the wiring must be of fairly heavy cross-section, since such lamps are sensitive to a potential drop which would cut little or no figure on a 110-volt circuit. For headlight service No. 10 wire, B & S., is about as small as appears desirable, and for the side and tail lights, No. 14 gives better results than a smaller section. As a rule it is desirable to

equip the lamps with candelabra sockets, as the miniature sockets often found on small tungstens are too small to withstand heavy vibration and to carry the necessary current. Subdivision of the circuits is desirable in the interest of operating convenience and economy, with the provision of one or two outlets for the connection of portable trouble lamps or lamps for the examination of maps and road books. An extra switch is an advantage if located in an out-of-the-way place, so that unauthorized handling of the lamps will not take place in the absence of the owner. Small lamps of this type can be used acceptably over the speedometer, cyclometer, and oil gauges. In the limousine, the low-voltage tungsten lamp is used to illuminate the clock, memorandum tablet, or the general interior, and in a high-priced car the cleanliness of the incandescent unit makes all other illuminants intolerable for inside service. In some cases the installation of brass piping for the wiring may be worth while, but whether brass, rubber tubing or ordinary insulated cable is used, the mechanical features of the wiring should receive skilled attention.

COST OF POWER IN THREE CENTRAL STATIONS.

The further one pushes the study of power production costs in the modern central station, the more apparent it becomes that the relation of the power business to the total output of the plant is an important and often a controlling factor in station economy. In exceptional cases a good load factor may be insufficient to overcome the handicap of poor equipment, but as a rule the establishment and maintenance of a considerable motor service is of more importance in enabling a company to enjoy low costs of production than almost any other factor. This is shown by the results of the past year's operation in three central stations having decided differences among themselves in the matter of power service in the communities which they supply.

The smallest of the three plants has a rated capacity of about 1,000 kilowatt. The station is equipped with a modern installaton of water tube boilers, there being four units of an aggregate capacity of 678 horsepower, the smallest boiler being rated at 104 horsepower, and the largest at 300 horsepower. The operating steam pressure is 120 pounds, and the boilers are hand-fired. The generating equipment is of a mixed character, consisting of three forty-four-kilowatt Bush arc machines, one 500-kilowatt turbo-alternator and three 150-kilowatt alternators of the 2,300-volt, three-phase type. All these dynamos except the turbo-alternator are driven by two Greene cross-compound condensing engines rated at 175 horsepower and 350 horsepower, the plant being in a transition stage from a line shaft and belted installation to a direct-connected outfit. The operation of the station requires the services of three engineers, one dynamo tender and two firemen, with the occasional assistance of the company's electrician.

In the past year's run the company generated 1,466,045 kilowatt-hours, and sold 1,217,485 kilowatt-hours. The power sales were notoriously small, being but 121,241 kilowatt-hours, or ten per cent of the total energy sales. The company burned 3,064 tons of coke during the year and about 1,200 tons of bituminous coal and breeze. The coke cost $3.59 per ton delivered at the boilers and the breeze and coal costs were $1.75 and $3.00 per ton respectively. The total cost of manufacture at the switchboard, including the items of fuel, oil and waste, water, station wages, repairs to steam, electric and building equipment, was $29,973, or 2.04 cents per kilowatt-hour delivered at the busbar. The fuel cost was $14,177, or 0.96 cents per kilowatt-hour, and the labor cost, $8,973, or 0.61 cents per kilowatt-hour.

The next larger station has a normal rating of 1,250 kilowatts. All the apparatus here is direct-connected, there being 150-kilowatt, 300-kilowatt and 800-kilowatt alternators direct driven by corresponding cross-compound condensing engines. The engines consist of one C. G. Cooper-Corliss 1,000 horsepower outfit, and two Providence Engineering Works engines rated at 450 horsepower and 240 horsepower respectively. Steam is supplied to these units from four water-tube boilers of 1,000 horsepower total rating, the sizes of the two boiler batteries being 400 and 600 horsepower. The operating steam pressure averages 130 pounds, and the plant is manned by four engineers, four firemen and one helper. The station design has remained practically unchanged since the plant was organized, and the additions to the equipment have been consistent with the primary installation.

The total output of the station at the busbars during the year was 1,602,371 kilowatt-hours, and of this 942,882 units were sold, indicating a poor efficiency of distribution. The company sold 248,537 kilowatt-hours for power service, or 15.5 per cent of its total generated energy. The boilers were hand-fired with abut 3,300 tons of Cumberland coal and screenings in the proportion of ten to six by weight, the average cost per ton of the coal being about $4.19 and of the screenings, $2.25. The total cost of manufacture at the station during the year was $24,633, or 1.54 cents per kilowatt-hour at the busbar. The larger items were, fuel, $13,-396, or 0.7 cents per kilowatt-hour, and labor, $7,759, or 0.48 cents per kilowatt-hour.

The largest plant of the three under consideration is equipped with six water-tube boilers having a total rating of 1,349 horsepower, installed in sizes varying from 175 horsepower to 350 horsepower, and operating at a steam pressure of 140 pounds. The electric generating equipment consists of two 500-kilowatt Curtis turbines driving 2,300-volt alternators, and three direct-connected alternators of 100, 264 and 475-kilowatt rating, driven by a twelve-inch by twelve-inch Armington & Sims engine, a fifteen by twenty-six by seventeen inch horizontal cross-compound condensing McIntosh & Seymour engine, and an eighteen by eighteen by thirty-six inch Lane & Bodley engine of similar type. The total normal capacity of the plant is 1,839 kilowatts. Its operation requires the services of five engineers,

three firemen and two helpers. There is no belted machinery in the station, judging from the records.

The company's fuel consumption for the year was 3,778 tons of New River coal, at an average cost of $3.88 per ton delivered. The total output of the plant at the busbars for the year was 2,137,800 kilowatt-hours, of which the company sold 1,760,842 kilowatt-hours. The power sales were 1,170,568 kilowatt-hours, or fifty-five per cent of the total energy generated. The total manufacturing cost at the busbars, without allowance for any fixed charges, was $23,469, or 1.10 cents per kilowatt-hour. Fuel came to $14,638, or 0.69 cents per unit, and labor to $6,717, or 0.27 cents per kilowatt-hour.

These figures indicate that in spite of a relatively high coal cost and a liberal assignment of station labor to the routine work of operation, the station with the largest power output made by far the best showing in the unit cost of manufacture. The plant with the poorest power business had the highest generating cost; the installation with the next best motor load showed a decided improvement in production economy, and the station with the largest power service made the best record of the three. A contributory factor in the economy of the larger stations was undoubtedly the use of direct-connected machinery in place of belted equipment; but since the two larger plants were similarly designed in this respect, the contrast between their operating costs is clearly due in large part to the improved load factor of the third installation considered. It cannot be too strongly emphasized that the day load, and for that matter an off-peak night load, is one of the most desirable objects to be sought in the efficient administration of a commercial power installation.

ELECTRIC RAILWAY OPERATING CONDITIONS IMPROVING IN MASSACHUSETTS.

Improved methods of operation are reflected in the statistics of electric railway earnings submitted recently to the Massachusetts Legislature by the Railroad Commission of that state. About 2,700 miles of electric railway track are operated in Massachusetts at present, or nearly enough to stretch from New York to Queenstown in a single line. This service gives employment to 17,575 persons, and requires the use of 7,546 cars of all types. The larger part of this trackage is located in the eastern or central part of the state, which is thickly populated, and very nearly 500 miles of track are devoted to the purely urban service of the Boston Elevated Railway Company. Nine hundred miles more are operated by the Boston & Northern and Old Colony system, so that half the total mileage of the Commonwealth comes under the administration of two presidents. This sort of centralization tends toward operating economies, and if the Boston Elevated Railway Company succeeds this winter in obtaining legislative permission to acquire operating control of suburban companies to the extent of forming a single administrative system of some 1,500 miles of track, there should be still further savings in expense with the prospect of a more complete through service in competition with the steam railroads radiating from Boston to points from ten to twenty miles out of the city.

The Massachusetts lines carried about 624,500,000 passengers the past year, compared with 602,400,000 in 1908. It is interesting to note that there were 5.4 passengers per car mile, compared with an average of about 5.1 for the past three years. The gross earnings per car mile were 27.19 cents, the best for ten years, and net earnings were 9.39 cents, also the best for a decade. In 1908 the earnings per car mile were 26.31 cents with the net of 8.75 cents, and last year the net earnings per mile of track were $4,111 against $3,828 in 1908. The gross earnings per mile of track for 1909 were $11,889, and for 1908 they were $11,507. These figures show a healthy growth in traffic which is an index of greatly improved business conditions, but they also indicate that the companies are paying closer attention to economies in operation, and from the engineering point of view this is most suggestive. It is clear that reduction of expenses has been constantly in the minds of traction officials during the past year in Massachusetts, for the roads carried more traffic with but a small increase in car mileage, and the costs of operation did not rise to the same extent as did the revenue per car mile or per mile of track. There have been savings in platform labor, power, equipment wear and tear, etc.

CONTINUOUS WORK IN LINE CONSTRUCTION.

In a somewhat general way most managers of public utility corporations recognize the desirability of carrying construction work forward on a continuous basis. The initial cost per unit of work done depends greatly upon the size of the job, but also upon the continuity of the operations undertaken. In a recent extension of the distribution circuits of an electric light and power company it was found that the erection cost per mile of line was $75 when the work was handled in piecemeal, against only $40 when the job was done by a single gang of linemen pushing the work forward continuously.

The company found that in extending its lines by irregular steps it was usually necessary to remove a portion of the previous construction, so that if an extra pair of power wires was needed on a four-pin cross arm, the arms had to be taken down for a considerable distance along the street, with replacement by a six-pin arm at each pole. An extension in a district previously served was relatively more expensive per mile than a straight piece of new construction into hitherto untapped territory. The difference indicated above in the erection cost per mile of line showed the company the importance of planning its work with the possible requirements of several years in mind not less than the desirability of pushing all overhead work to completion with all possible freedom from interruptions.

Northwestern Cedarmen's Association Convention.

The annual convention of the Northwestern Cedarmen's Association was held at Chicago, Illinois, January 11 and 12. Headquarters were established at the Hotel La Salle. The first meeting was called to order at 11:00 o'clock Tuesday morning by President E. L. Clark, who in a brief address outlined the present condition in the pole industry. The inactivity on the part of large consumers had robbed the pole men of a competitive buying market on the part of the small consumers, with a result that there had been little trade to speak of during 1909. Mr. Clark thought that the demand for the season of 1910 would be better than normal. He made a number of strong suggestions concerning the value of co-operation and the restrictions which should be placed upon the dissemination of information to those companies not co-operating with the secretary in the preparation of the Association's data.

The report of the secretary showed some interesting figures, and the report of the treasurer showed a balance on hand January 11 of $1,206.63.

On Tuesday evening a very enjoyable banquet was held, addresses being made by a number of prominent members. Practically every one of the twenty-seven members in attendance were present at the banquet, and this attendance was supplemented by a considerable number of invited guests.

At the session held Wednesday morning the following officers were elected:

President, T. M. Partridge, T. M. Partridge Lumber Company, Minneapolis, Minn.

Vice-President, J. E. Gerich, MacGillis & Gibbs, Milwaukee, Wis.

Treasurer, W. B. Thomas, White Marble Lime Company, Manistique, Mich.

Directors—H. S. Gilkey, Pendleton & Gilkey, Minneapolis, Minn.; E. L. Clark, Valentine-Clark Company, Chicago, Ill.; L. A. Page, Jr., Page & Hill Company, Minneapolis, Minn.

Curing Arterio-Sclerosis by High-Frequency Currents.

In the application of high-frequency currents one has to deal with intensity or tension currents, according to whether they are furnished by the primary or secondary solenoids. These currents differ considerably in their physiological effects, for while the blood pressure is diminished by the intensity currents, it is increased by the tension currents. This article (which appeared originally in the *Zeitschrift fur Schwachstromtechnik*, Volume 4, 1909, page 225) says that the beneficial effects of high-frequency currents in arterio-schlerosis are due to their quality of diminishing the blood pressure. The disease mentioned produces a change in the arterial walls and renders them brittle; they contract at the same time and a considerable increase in the blood pressure is thus brought about. Moutier, of Paris, explains these phenomena by a poisonous substance adhering to the arteries and states that the high-frequency currents dissolve the poisonous matter and restore normal conditions. Other investigators, however, claim that the decrease of blood pressure alone and the consequent diminution of friction against the inner walls of the arteries is sufficient to make them gradually resume their normal condition.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, November 25, 1909.*

Mineral Products of the United States.

The United States Geological Survey, Department of the Interior, through its director, George O. Smith, has issued a table of the mineral products of the United States for the calendar years 1899 to 1908. The following is an abstract of this table only including products of interest to the electrical trade:

Products.	1907. Quantity	1907. Value.	1908. Quantity.	1908. Value.
Copper, pounds	868,996,491	$173,799,300	942,570,721	$124,419,335
Lead, short tons	365,166	38,707,596	310,762	26,104,008
Zinc, short tons	223,745	26,401,910	190,749	17,930,406
Aluminum, pounds	17,211,000	4,926,948	11,152,000	2,434,600
Platinum, ounces	357	10,589	750	14,250
Bituminous coal, short tons	394,759,112	451,214,842	332,573,944	374,135,268
Pennsylvania anthracite, long tons	76,432,421	163,584,056	74,347,102	155,178,849
Clay products		158,942,369		133,197,762
Asbestos, short tons	653	11,899	926	19,624
Bauxite	97,776	480,330	52,167	263,968
Graphite Crystalline, pounds	4,947,840	171,149	2,288,000	132,840
Graphite Amorphous, short tons	26,803	125,821	1,443	75,250
Magnesite, short tons	7,561	22,683	6,587	19,761
Tungsten, short tons	1,640	890,048	671	229,955

Effects of Ultra-Violet Rays on the Eyes.

In a review of the progress attained in ophthalmology during the past year, *The Lancet* (London, December 25, 1909) says that much attention has been devoted of late to the action of special rays upon various parts of the eye, and particularly to the relative part played by ultra-violet rays. Sun-burn, snow-blindness, and ophthalmia electrica have long been recognized as due to this agency. Less certain is their influence in producing erythropsia, and it is emphatically denied by Best. Experimentally the effects of ultra-violet rays have been investigated by Hess, Birch-Hirschfeld, Schanz and Stockhausen, and others. The detrimental qualities of these rays have, perhaps, been over-estimated, and there is now a tendency to attribute more of the results to rays of the visible spectrum. At the same time there is ample evidence that excess of rays of short wave length in ordinary illuminants is deleterious, and it is fortunate that ordinary glass globes form an effectual barrier to the pasage of most of them.

Sterling Electrical Manufacturing Companies Sales Convention.

The semi-annual meeting of the Sterling Electrical Manufacturing Company's sales organization was held at Warren, Ohio, December 4, 5 and 6. Many subjects of interest were discussed at this meeting, and a great deal of enthusiasm was displayed. S. E. Doane, chief engineer of the engineering department of the National Electric Lamp Association, gave the salesmen a talk on the three-voltage rating of lamps, as applied to both tungsten and carbon filament lamps.

Mr. Williams gave a talk on high efficiency carbon lamps, and P. S. Dodd explained the new Mazda brand of tungsten lamps. Mr. Dodd stated that owing to recent developments in the manufacture of tungsten lamps, the word "tungsten" was not sufficient, and since the process of the manufacture of tungsten lamps varies so widely, it became necessary to use some word that would represent this higher development of the tungsten filament.

Mr. March of the tungsten lamp works give a lecture on high candlepower series-burning tungsten lamps, explaining the uses of the new street series lamp, burned four in series, on regular multiple circuits.

The balance of the meeting was devoted to the subject of properly lighting office buildings with tungsten lamps, and to subjects of personal interest to the Sterling organization.

Bernard E. Sunny.

Bernard E. Sunny, who for many years has been prominent in electrical circles in Chicago, was born in Brooklyn, N. Y., in 1856. Although a young man Mr. Sunny has been connected with the electrical industy for a long time. He began as master of the key for the Atlantic & Pacific Telegraph Company, where after serving his apprenticeship as a messenger he remained until 1875, when he became Chicago operator for the company. Soon after he was made night manager, and later manager of the Chicago office. He left the telegraph service in 1879 to become superintendent of the Bell Telephone Company, and later of the Chicago Telephone Company, the latter representing the consolidated Bell and Edison companies. He remained in the telephone service nine years, and was closely identified with the first successful efforts to operate telephone wires underground. He became president of the Chicago Arc Light and Power Company in 1888, at that one of the largest central stations in the country, and made his first successful attempt to work the feeder system for high-pressure arcs underground. He became western manager of the Thompson-Houston Electric Company in 1890, and later the western manager of the General Electric Company. He was twice elected a member of the board of directors of the Columbian Exposition, and was president of the Intramural Railway at the World's Fair in Chicago. In 1908 Mr. Sunny resigned as vice-president and western manager of the General Electric Company, and on May 13, was elected president of the Chicago Telephone Company. He is also vice-president of the American Telephone and Telegraph Company, and a director of the General Electric Company.

B. E. SUNNY,
President Chicago Telephone Company.

Growth of Gas-Producer Power Plants.

More than 500 producer-gas power plants, ranging in size from fifteen to 6,000 horsepower, are now in operation in the United States. About eighty-eight per cent of these plants are running on anthracite coal, a few on anthracite or coke, and the remainder on bituminous coal and lignite. In a bulletin on the recent development of the gas-producer power plant in the United States (Bulletin 416), just issued by the United States Geological Survey, R. H. Fernald, consulting engineer, states that the internal-combustion engine has already become a serious rival of the steam engine in many of its applications, and that the development of the large gas engine within the last few years has been extremely rapid. Only nine years ago a 600-horsepower engine exhibited at the Paris Exposition was regarded as a wonder, but today four-cycle, twin-tandem, double-acting engines of 2,000 to 3,500 horsepower can be found in nearly all well-equipped steel plants, and some plants in this country contain several units rated at 5,400 horsepower each.

The tests made by the Survey, 168 in all, included 138 on bituminous coals, nine on subbituminous coals, ten on lignite, and eleven on miscellaneous fuel. The average consumption of fuel for a brake-horsepower hour was 1.36 pounds of bituminous coal, or 1.99 pounds of lignitic coal, the minimum consumption being 0.84 pound and 1.48, respectively. Comparative tests of seventy-five bituminous coals under a water-tube boiler and in the gas producer showed that the average fuel consumption per brake-horsepower in the steam plant was 2.7 times that in the producer plant. Several low-grade coals and lignites that were of little value, or even worthless, under the steam boiler gave excellent results in the producer. Other low-grade fuels —such as roof slabs, culm, and washery refuse, and even a bone coal that contained forty-four per cent of ash— have been used to advantage in the producer under proper commercial conditions.

Professor Fernald solicited the views of the principal manufacturers of gas producers on the present status of the gas producer as a source of power, with particular reference to the special conditions that oppose or make for its introduction. In addition, he or his assistant, C. D. Smith, personally visited sixty-nine different plants that furnish power for a great variety of purposes, to determine the economy and reliability of the plants under average conditions.

After this inspection Professor Fernald decided: (1) That the plants as a whole are giving remarkable satisfaction in view of the brief period of development. (2) That the most serious difficulty seems to arise from the lack of competent operators to run the plants, though there are many more competent operators today than three years ago. (3) That the situation regarding misrepresentations and misunderstandings resulting from incompetent salesmen has with the stronger companies greatly improved. (4) That the situation regarding trouble due to manufacturers neglecting plants that have been installed and paid for has changed decidedly for the better. Even to-day this neglect causes reputable manufacturers a good deal of trouble.

The bulletin, which contains charts showing the growth of producer-gas plants and the location of the plants now in operation, may be had free of cost by applying to the Director, United States Geological Survey, Washington, D. C.

Direct Cable to Brazil.

In a recent letter, Vice Consul General Joseph J. Schlecta, of Rio de Janerio, states that the Federal Government of Brazil has granted concessions which may eventually lead to direct cable connections between Brazil and the United States. Mr. Schlecta's letter is in part as follows: "The concession authorizes the establishment and maintenance of a coastwise cable service extending from the mouth of the Amazon to the southernmost point of the Brazilian coast. Such a cable service, if actually established, will prove a serious competitor of the British cable company, which now enjoys the exclusive privilege for submarine cable service along the Brazilian coast, except for the telegraph service of the Government. Efforts are being made to cause the concession to be withdrawn, and the present status of the project is uncertain. Should the concessionaire maintain his position successfully, the opportunity would prove an excellent one for the investment of American capital in a connecting cable.

Telephone Expansion in United States.

Telephones in the United States increased at the rate of 2,000 a day during 1909 on the Bell system alone, according to figures issued recently by the American Telephone and Telegraph Company, and during the same period about 400,000 miles of copper wire were added to the company's mileage.

The actual number of telephones included in the Bell system at the close of the year was, in round numbers, $5,000,000, of which 3,500,000 were owned directly by the associated Bell companies and 1,500,000 by companies not financially controlled by the American Telephone and Telegraph Company. The total mileage of the Bell system at the close of the year was 10,250,000 miles.

Holophane Company Enlarges Its Western Display Rooms.

The Holophane Company has greatly enlarged its display room facilities at 298 Wabash avenue, Chicago, Ill., and increased its facilities for the testing and demonstration of various sources of illumination. C. A. Howe, western manager, extends a cordial invitation to electrical engineers, contractors, central station men, architects and builders to visit these new quarters whenever they have any problem to solve involving the use of electric or other forms of illumination.

The Chicago Electrical Show.

Arrangements have been completed for the fifth annual Electrical Show at the Coliseum, Chicago, Ill., under the

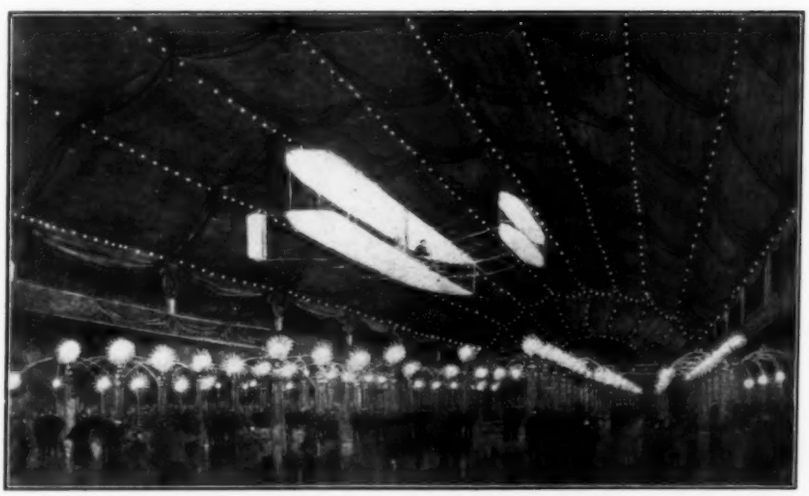
THE ELECTRICAL SHOW POSTER.

auspices of the Electrical Trades Exposition Company. The exhibition will be formally opened at 8:00 p. m., Saturday evening, January 15.

Holophane reflectors, and shielded from the direct vision with art glass effects. The overhead scene will be a mass of gold and silver tinsel, which under the rays of powerful light projectors will scintillate with all the colors of the rainbow. Suspended from the roof-trees in the middle of the great dome of the Coliseum will be the Wright aeroplane, which has been lent by the United States Government to the exposition management, and which will be directly in charge of Lieutenant B. B. Faulois, and a corps of six men from the aeronautical squad representing the War Department.

The exhibit of the Commonwealth Edison Company has a particularly instructive value, various applications of electricity being shown which perhaps few are familiar with. The space is divided into two general parts, in which are exhibited power machinery of the alternating-current and direct-current types. One of the principal features is a section devoted to artificial refrigeration, showing motor-driven automatic ice machines and refrigerators.

The next section is occupied by electric tempering and hardening-machines, which are loaned by the General Electric Company. In connection with this exhibit an automatic bolt-cutter and rivet-spinner, a power hacksaw and



REPRODUCTION OF ARCHITECT'S DRAWING OF INTERIOR OF COLISEUM, CHICAGO ELECTRICAL SHOW, JANUARY 15-29.

The decorations and lighting effects, it is understood, will far surpass any of the remarkable efforts made heretofore. Under the direction of the architects, D. H. Burnham and Company, an entirely novel lighting scheme has been arranged consisting principally of high-powered tungsten lamps, made up in clusters with

punch-press all electrically-driven are shown.

In the next section is shown a complete line of electrically-driven tinware machinery, and a feature of this department is the manufacturing of tin cooky cutters on the premises, which are distributed as souvenirs.

Probably one of the most instructive departments will be that devoted to the application of electricity to the printing trade. A complete outfit will be exhibited, including electrotyping machines, folders, cutters and presses, and literature is being printed, bound and distributed at the Show. That no feature of this exhibit may be neglected a complete electrotyping outfit is also exhibited and photographs are rapidly transformed to electrotypes for use in the printing department.

A very interesting part of the Commonwealth-Edison exhibit is in the Annex, wherein they have installed a Karr portable garage, equipped with mercury arc rectifiers which charge storage batteries on an electric vehicle. There is also a permanent garage equipped with mercury arc rectifiers and electric tire pumps for inflating automobile tires. Various other apparatus found in a garage is shown, all being electrically-driven.

It is a feature of this exhibition that all machines and appliances shown are actually in operation, thus giving the sightseer an opportunity to become familiar with the many applications of electricity.

The accompanying diagram and key will serve to locate the numerous exhibitors and will indicate also that every bit of available space in the huge building has been subscribed for. There will be the usual special days, the schedule up to date being arranged as follows:

SPECIAL DAYS.

Monday, January 17 — Benjamin Franklin Day. Electrical engines for souvenirs.

Tuesday, January 18—Oxidized silver bookmark for souvenirs.

Wednesday, January 19—Chicago Electric Club Day. Souvenirs.

Thursday, January 20—Illuminating Engineers' Day.

Friday, January 21—Sons of Jove Rejuvenation. Wisconsin Electrical Association Day.

Saturday, January 22—Students' Day.

Monday, January 24—Souvenir Day. Special "Electrical Show" placques.

Tuesday and Wednesday, January 25-26—Telephone and Aviation Days.

PLAN OF COLISEUM FLOOR, CHICAGO ELECTRICAL SHOW, JANUARY 15-29, 1910.

American Steel & Wire Co.—D, 17-18.
Appleton Electric Co.—A, 6.
American Ironing Machine Co.—C, 3 (W. ½).
Acme Wire Company—E, 7-8.
American Telephone & Telegraph Co.—D, 19.
Allis-Chalmers Company—F, 17-18-19.
American Sign Co.—I, 1.
American School of Correspondence—C, 6 (E. ½).
Automatic Printing Press—B, 8.

Bishop & Babcock Company—A, 3.

Commonwealth Edison Company—N, 1 to 26 incl.
Crane Company—D, 1.
Chicago Pneumatic Tool Co.—E, 5-6.
Chicago Fuse Wire & Mfg. Co.—D, 2 (W. ½).
Cutler-Hammer Mfg. Co.—B, 2-3.
Chicago Telephone Company—D, 20.
Como Electrical Company—B, 7.
Collins Wireless Telephone Co.—F, 15.
Consolidated Electric Appliance Co.—J, 6.

Del Sales Company—B, 5.
Duntley Mfg. Co.—C, 23-24.
Driver-Harris Wire Co.—E, 15.

Electrical Record—E, 20 (E. ½).
Electrical Review Publishing Co.—E, 12.
Electrical Testing Laboratories—A, 9-10.
Electrical World—F, 21 (W. ½).
Electrical Age Company—H, 7.
Electric Cleaner Company—D, 15.
Electro-Magnetic Tool Company—E, 19 (E. ½).
Empire Vacuum Company—J, 2.
Electrocraft Publishing Co.—B, 10.
Enterprise Optical Mfg. Co.—H, 8.
E-Z Vacuum Cleaning Co.—F, 20 (E. ½).
Electric Storage Battery Co.—F, 5.
Everson & Company, C. G.—A, 2.
Excello Arc Lamp Company—D, 2 (E. ½).

Federal Electric Company—J, 3-4.
Fort Wayne Electric Works—C, 13.
Fairbanks, Morse & Company—C, 4.

General Electric Co.—F, 1-2-9-10.
General Vehicle Company—D, 22-23.
General Acoustic Company—F, 3.
Grand Ledge Clay Product Co.—D, 4 (W. ½).
Gest, G. M.—F, 6.

Hahl Automatic Clock Company—F, 20 (W. ½).
Hurley Machine Company—F, 4-12.
Hinde & Dauch Paper Co.—D, 10.
Hoskins Mfg. Co.—E, 4.
Hoover Suction Sweeper Company—D, 5.
Houston Mfg. Co.—J, 1.
Hamler-Eddy Smoke Recorder Co.—I, 5.

Illinois Appliance Company—A, 8.

Jackman, G. L.—B, 4.
Judd Laundry Machine Company—G, 6.
Judd Oscillating Cleaner Co.—B, 6.

Klein & Sons, Mathias—E, 20 (W. ½).
Kimble Electric Company—D, 13.
Keller Mfg. Co.—D, 21.
Kratz, A. W.—A, 5.
Kiewert Company, Chas. L.—F, 11.

Long Beach Electric Mfg. Co.—A, 4.

Macbeth-Evans Glass Co.—C, 21.
Milwaukee Vacuum Mchy. Co.—C, 14.
Manhattan Electrical Supply Co.—D, 4 (W. ½).

National Acme Mfg. Co.—F, 22 (E. ½).
National Carbon Company—C, 12.
Neville Ill'g Sign Co.—B, 5½.
Newgard & Company, Henry—F, 13.
North Shore Electric Co.—E, 11.
Nohe Electric Renovator Company—D, 6 (W. ½).
National Electric Lamp Assn.—E, 21 to 24.

Oral & Motion Mfg. Co.—J, 7.

Pelouze Electric Heater Co.—D, 9.
Popular Electricity—C, 5.
Perfection Vacuum Cleaner Co.—E, 3.
Pacific Electric Heating Co.—G, 7.

Swedish-American Telephone Co.—C, 15-16.
Simplex Electric Heating Company—C, 11-19-20.
Stolz Electrophone Company—D, 3.
Sefton Mfg. Co.—F, 7.
Schneible Company—I, 10-11-12.
Shelton Electric Company—F, 21 E, 13.
Stromberg-Carlson Tel. Mfg. Co.—(E. ½).
Stromberg Electric Mfg. Co.—E, 14.
Shaw Company, Walden W.—C, 6 (W. ½).
Studebaker Bros. Mfg. Co.—E, 16.

Telephony Pub. Co.—D, 12.
Temple Auto Co., Ralph—F, 23.
Thompson Bros. Co.—D, 4 (E. ½).
Tel. Electric Company—H, 3-4.

U. S. Light & Heating Co.—C, 22.

Vulcan Electric Heating Co.—A, 7.

Westinghouse Electric & Mfg. Co.—C, 7-8.
Wonderful Pump—D, 7.
Western Electric Co.—D, 11.

Central-Station Accounting and Bookkeeping in New York State.

Considerable interest has been attracted by the work of the committee on accounting of the Empire State Gas and Electric Association. On page 1234 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 25 last a reference was made to this work but on account of its brevity the article has been misconstrued in some quarters.

The accounting committee of the association did not prepare any system of accounting, but merely submitted to the members at the annual convention on November 17 and 18, 1909, some sample forms which might be used by them if they so desired, to assist in keeping the accounts prescribed by the Public Service Commissions. The report submitted really dealt more with bookkeeping than it did with accounting. The facts in some detail are as follows:

On behalf of the committee on accounting, E. C. Scobell, chairman, presented the report. It had been found early in the year that a considerable demand existed among the smaller companies for an explanation of bookkeeping methods and for sample forms by means of which the classification of accounts prescribed by the commissions could be kept. In order to meet this demand the committee had prepared a report which was divided into a number of different sections as follows:

Comments on Capital Accounts as Prescribed by the New York Public Service Commissions.

General Office Accounting and Bookkeeping.

The Commercial Department.

Store-Room and Job Order Accounting.

Pay Roll Accounting.

Accompanying this report was a set of sample forms printed in full size and comprising the following:

Cash book, journal, general ledger, accounts payable voucher, check voucher, voucher record, expense and improvement ledger, transfer voucher, trial balance and summary sheet, service orders, meter applications, set and remove meter orders, meter set reports, meter records, meter reading sheets, consumers' ledgers, bill forms, sales order and store-room requisitions, merchandise sales book, miscellaneous accounts receivable ledger, store-room requisition, stock sheet, job cost sheet, daily time slip and pay roll book.

The association decided that one copy of the report should be given to each member company and that other copies could be purchased at a nominal price ($5) from the association.

Lighting of Broadway, New York City.

TO THE EDITORS:

In your issue of December 18, 1909, on page 1195, an article appears which would indicate that the author in making his point used accurate information as to the lighting of Broadway by this city.

He has stated that there are about forty lamps to the half mile north of 135th Street, while there are only thirty, which cost $2,850 per annum, instead of $3,600.

On that portion north of 35th Street, there are eighteen lamps in the first half mile, which cost $2,124.25 per annum, instead of $450. This lighting will be increased by eight additional arc lamps, so that the cost will be $2,884.25.

The reason why there are more lamps in the upper section is not due to the absence of illuminated signs, but owing to the fact that it is a parkway, 150 feet in width, with center plots, and the street is lined with trees, whereas the lower portion is only 100 feet in width.

The cost per annum per square foot is approximately the same in both sections at the present time. In this city it appears that at congested points in spite of a large number of signs, the city lighting is stronger than at other points. A notable instance of this is that at the great street intersections, such as Broadway and Fifth Avenue, Times and Long Acre Squares, ten and twelve-ampere flaming arc lamps of high power are now being installed, although many of the largest illuminated signs are in nightly use at these points.

C. F. LACOMBE,
Chief Engineer of Light and Power, Department of Water Supply, Gas and Electricity.

Department of Water Supply, Gas and Electricity.
New York, N. Y., January 3, 1910.

American Electric-Light Plant in Manchuria.

An American consul-general at Mukden reports that through the initiative of that consulate an American company is arranging with the Chinese authorities to install an electric light plant at Changchun (Kuanchengtzu), the junction city of the Japanese and Russian railway lines. The initial cost of the plant will be approximately about $90,000. Most of the material for this installation will be of American manufacture and the installation will be supervised by an American.

Restrictive Recommendations for Massachusetts Public-Utility Companies.

In the annual report of the Massachusetts Gas and Electric Light Commissioners the following recommendations for future legislation are put forth:

That the provisions of section forty-seven of chapter 110 of the revised laws be so amended that gas companies may not engage in the supply of electricity by unanimous consent of their stockholders, but only as otherwise provided in the existing law and that electricity supply companies shall be authorized to supply gas only in the same manner that gas companies are now authorized to supply electricity.

That public service corporations be excluded from the provisions of law permitting corporations organized under general laws or created by special charter to extend or remove their business to any other city or town in the Commonwealth.

The board strongly recommends a continuance of the present policy of Massachusetts in relation to the declaring of dividends by corporations, and believes that experience has demonstrated the wisdom and value of the statute which reads: "No telegraph, telephone, gas light, electric light, steam railroad, street railway, aqueduct or water company established under the laws of this Commonwealth shall declare any stock or scrip dividend or divide the proceeds of the sale of stock or scrip among its stockholders."

Election of Officers and Annual Meeting Western Society of Engineers.

The letter ballot for officers of the Western Society of Engineers resulted in the election of the following-named gentlemen to conduct the society's affairs during 1910:

J. W. Alvord, president; O. P. Chamberlain, first vice-president; A. Bement, second vice-president; W. K. Hatt, third vice-president; A. Reichman, treasurer; L. E. Ritter, G. M. Brill and W. W. Curtiss, trustees for one, two and three years, respectively. With the exception of Prof. W. K. Hatt, of Purdue University, LaFayette, Ind., these gentlemen are all of Chicago, where the home of the society is located in the Monadnock Block.

These new officers were inaugurated at the annual meeting and dinner of the society at the University Club on the evening of January 12. A report of this meeting will be given next week.

Chicago Electric Club.

Electrical inspection; its scope and its benefits was the subject of the address delivered at the Chicago Electric Club on Wednesday, January 5, by B. E. Blanchard, of the Underwriters' Laboratories, following the regular midday luncheon.

Mr. Blanchard briefly reviewed the electrical industry and showed how electrical inspection became a necessity as the uses of electricity increased and became more general. In 1881 alone, although there existed only sixty-five electrical installations, twenty-three fires occurred, during a period of six months, due to the faulty installations or electrical trouble. Shortly after this a number of rules were gotten out by insurance companies, covering installation of those days.

The speaker referred to a paper read before the Western Electrical Inspectors' convention by Alexander Henderson, which also dealt with the early days of electricity and gave an amusing account of the "first electrical inspector."

Mr. Blanchard outlined the qualifications of an electrical inspector and enumerated the benefits of inspection. He also dealt with the subject of reinspection and said that although Atlanta, Ga., was the only city at present having such a system others would undoubtedly follow.

A number of instances of faulty car wiring were given. The damage in these cases being so great as to necessitate the addition of a section in the code covering this class of wiring.

The third annual smoker and entertainment was held on Friday evening, January 7, 1910, at the rooms of the Chicago Automobile Club.

An excellent vaudeville programme was carried through, a number of artists of high repute entertaining the members during the early part of the evening. The entertainment consisted of singing and dancing, some excellent music, and some remarkable caricaturing, a number of the prominent members of the club posing for the cartoonist.

Following the vaudeville a very enjoyable Dutch supper was served in the billiard room, the occasion being enlivened by music, story telling and some excellent impromptu singing.

The entertainment was planned and carried out under the direction of George H. Porter and Roy M. Van Vleit.

Joint Meeting of Engineering Societies at Boston.

With the idea of increasing the friendly relations between the Boston sections of the national engineering societies and particularly of promoting the erection of a united engineering building to serve the Boston societies as the Engineering Societies Building does for the New York headquarters, there will be held on the evening of January 21, a joint meeting of the Boston sections of the American Society of Mechanical Engineers and of the American Institute of Electrical Engineers with the Boston Society of Civil Engineers. This meeting will be held in the Hotel Somerset and will be preceded by a dinner and reception in honor of president-elect George Westinghouse of the American Society of Mechanical Engineers, president-elect John A. Bensel, of the American Society of Civil Engineers; president Lewis B. Stillwell, of the American Institute of Electrical Engineers, and president G. B. Francis, of the Boston Society of Civil Engineers.

After the social and more general features of the programme are concluded an illustrated lecture will be delivered by Charles B. Edwards, of the Fore River Shipbuilding Company, on the machinery equipment of the United States battleship *North Dakota*.

Franklin Institute Election.

The annual election of the Franklin Institute, Philadelphia, Pa., will be held on Wednesday, January 19, between the hours of 4:00 and 8:00 p. m. The following nominations have been made:

President (one year) Walton Clark.

Vice-president (to serve three years) Henry Howson.

Treasurer (to serve one year) Cyrus Borgner.

Auditors (to serve three years) Samuel P. Sadtler; (to serve two years) John C. Trautwine, Jr.

Managers (to serve three years) Edwin S. Balch, W. C. L. Eglin, Alfred C. Harrison, Chas. A. Hexamer, Alex. Krumbhaar, Chas. E. Ronaldson, E. H. Sanborn, Walter Wood.

Committee on Science and the Arts (to serve three years) James Christie, G. H. Clamer, Richard Gilpin, Wm. O. Griggs, Chas. A. Hexamer, Henrik V. Loss, Luther D. Lovekin, Thos. C. McBride, W. B. Riegner, J. Y. McConnell, E. S. Powers, J. W. Ridpath, L. F. Rondinella, Arthur J. Rowland, Thomas Spencer, Wm. H. Thorne, Walton Clark, Jr.

Annual Meeting of the Wisconsin Electrical Association.

The annual meeting of the Wisconsin Electrical Association will be held at Milwaukee, Wis., Wednesday and Thursday, January 19 and 20. Headquarters will be established at the Hotel Pfister, and a programme of especial interest to central-station and street-railway men has been arranged. The entertainment committee has been putting forth strenuous efforts to have ready for those in attendance an agreeable and edifying programme. It is understood that the committee's plans are about completed and that it is expected that the entertainment will be highly creditable. The committee includes H. P. Andrae, W. P. Pinckard and Frank G. Bolles.

The following programme has been announced:

WEDNESDAY FORENOON.

Meting called to order at 10:00 a. m. in Club Room of Hotel Pfister, Milwaukee.

Registration and roll call.

Reading of minutes of last meeting.

Report of the executive committee.

Secretary-treasurer's report.

President's address.

Reports of committees.

"Inventories," paper by W. R. McGovern, engineer Wisconsin Telephone Company.

WEDNESDAY AFTERNOON.

"Electric Automobiles," paper by O. M. Rau, electrical superintendent The Milwaukee Electric Railway and Light Company.

"Handling Complaints and Enforcing Discount Dates," paper by W. N. Putnam, superintendent, Menominee-Marinette Light and Traction Company.

"Electric Railway Fares," paper by J. P. Pulliam, superintendent, Wisconsin Electric Railway Company.

THURSDAY MORNING.

"Profit-Sharing by Public Service Corporations," discussion by W. H. Winslow, secretary, Superior Water, Light and Power Company.

"Wheel and Axle Maintenance," paper by W. J. Kelsh, master mechanic Wisconsin Electric Railway Company.

"Cooking and Heating by Electricity," paper by W. B. Voth, general superintendent, Sheboygan Light, Power and Railway Company.

THURSDAY AFTERNOON.

"Indeterminate Permits," a general discussion. The Railroad Commission will be represented and attorneys of member companies are invited.

Plans for Philadelphia Electrical Exhibition.

A meeting of the representatives of the electrical interests in Philadelphia was held in the Engineers' Club on January 7, to discuss the final arrangements for the Philadelphia Electrical Exhibition to be held in that city February 14 to 26. W. C. L. Eglin, past president of the National Electric Light Association, occupied the chair.

Details of the booth construction, decorations, publicity campaign, etc., were discussed, and a publicity committee consisting of the advertising managers of the several electric public service companies of the city was appointed.

An advisory committee consisting of prominent citizens and business men with the Hon. John E. Reyburn, Mayor of Philadelphia, as chairman was also appointed. Those who have already signified their intention of exhibiting are: Commercial Truck Company, Century Electric Company, Judson C. Burns, Condit Electric and Manufacturing Company, Keystone Telephone Company, Westinghouse Electric and Manufacturing Company, Duntley Manufacturing Company, Robbins & Myers, *Electrical World*, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Werner Kaufman, Woodland Printing Company, Fort Wayne Electric Works, Keller-McManus Company, Shelton Electric Company, General Electric Company, The Philadelphia Electric Company, Jas. E. Caldwell and Company, Engineering Equipment Company, Electric Storage Battery Company, Simplex Electric Heating Company, Studebaker Electrics, Edward Miller and Company, Hurley Machine Company, Roller-Smith Company, Williamson Motor Company, Philadelphia Electrical Contractors' Association, Nernst Lamp Company, Philadelphia Specialty Company, Vacuum Engineering Company, Johns-Manville Company.

The exhibition is rapidly assuming a civic aspect and will be one of the most varied and comprehensive events of this character ever held. The number and variety of exhibits already secured, several weeks in advance of the opening dat, augurs well for the success of the project from every point of view.

Western Electric Bonds.

Announcement is made that the Western Electric Company, which is the manufacturing concern of the American Telephone and Telegraph Company, will issue and sell at once $5,000,000 of the $15,000,000 five per cent general mortgage gold bonds which were authorized by the stockholders at a special meeting held for the purpose November 5, 1907.

The company has filed the trust deed securing the mortgage against which the bonds are to be issued. The Merchants' Loan and Trust Company, of Chicago, is named as trustee, and the mortgage, which is dated December 30, 1909, more than two years after the authorization, covers all of the corporation's property, real and personal, in Chicago and New York.

The bonds run for twelve years, and the company reserves the right to pay any or all of the outstanding issue January 1, 1912, or on any interest day thereafter, with accrued interest and a premium of five per cent.

The proceeds of the sale of the first $5,000,000 will be used to take the place of commercial paper and in liquidating current indebtedness. The remaining $10,000,000 can be sold from time to time at the discretion of the board of directors.

The Western Electric Company has an authorized capitalization of $25,000,000, of which $15,000,000 is outstanding. The American Telephone Company owns more than $12,000,000 of the latter amount.

Opportunity for American Equipment.

An American consul in Asia has sent a comprehensive report on the possibility of establishing an electric light and power plant in a large city in Asia. The consul gives the proposition thorough consideration from every standpoint, and states in conclusion that an excellent opportunity is now presented for the investment of American capital and the introduction of electrical equipment.

Interested parties may have a copy of this report upon application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C., and referring to File No. 4356.

Telegraphers' Nine-Hour Law.

The United States Circuit Court has decided in favor of the railroads in the case of the nine-hour telegraphers' law. The court, Judges Grosscup, Baker and Seaman, reversed the ruling of the lower court, Judge Landis, and held that the law, which provides for a nine-hour day for railway telegraphers, does not mean that the hours shall be consecutive.

Lieutenant Faulois Entertained at a Laboratory Supper.

On the evening of Sunday, January 9, Lieutenant B. B. Faulois, who is present in Chicago in attendance at the Electrical Show representing the War Department, was tendered an informal supper by Mr. and Mrs. Frank L. Perry in the laboratory of Mr. Perry. The long table was set in the spacious room where Mr. Perry conducts his researches and heavier experiments, and the decorations were in the nature of apparatus illustrating the development of the aeroplane and its adaptability as a wireless sending and receiving station.

Among those present were Tracy C. Drake, president of the Drake Hotel Company, and Mrs. Drake, Mr. and Mrs. J. E. Jenkins, Miss Rene Mansfield, the guest of honor, Lieutenant Faulois, and A. A. Gray.

Twenty-Fifth Anniversary of Commercial Cable Company.

Two hundred of the officers and staff in New York of the Commercial Cable Company were dined on January 8, at the Hardware Club, Postal Telegraph Building, on invitation of Clarence H. Mackay, to commemorate the twenty-fifth anniversary of the corporation.

Several favors were given, the most interesting being a small piece of the Commercial Company's original cable, which was recovered recently from great depths in the Atlantic after having been submerged twenty-five years.

Mr. Mackay, as host of the evening, welcomed the men and paid tribute to George G. Ward, the vice-president and general manager. He also proposed a silent toast to the memory of Dumont Clark and to Charles Gill.

In referring to the future of the company Mr. Mackay pointed out that this was no time to relax efforts in view of the recent combination and declared that the Commercial Cable Company would never lose its independence or identity as long as he lived.

The Non-Magnetic Yacht "Carnegie."

At the 671st meeting of the Philosophical Society of Washington, held in George Washington University on November 20, 1909, two papers were presented on the non-magnetic yacht *Carnegie*, as follows: "The First Cruise of the *Carnegie* and Her Equipment," by Dr. L. A. Bauer; "The Producer Gas Engine on the *Carnegie*," by Carl D. Smith.

The Seebach-Wettingen, 15,000-Volt Railway.

For reasons which are not clearly known at present, the Swiss Federal Railroad Administration decided not long since that the Seebach-Wettingen electric line was not to be taken over by the Federal Railroads, as was expected. It will be remembered that the Oerlikon Company, in connection with the Siemens-Schuckert firm, had equipped the present line lying in the suburbs of Zurich some years ago and for a considerable period it has been running on the electric system. The Oerlikon firm had made the engagement to operate the line until July 3, 1909, and it expected that after that time the Federal Railroads would come to an understanding as to the future operation of the electric road. Such was not the case, however, and as the Federal Railroads Administration was free to accept or refuse the electric plant, it came to the latter decision, no doubt for financial reasons, for otherwise the line had proved very successful in its operation. It will be remembered that the use of electric trains on the Seebach-Wettingen line commenced on December 1, 1907, and was operated by the above-mentioned company until December 1, 1908. Such operation was then extended by a new contract with the Swiss Federal Roads to July 3, 1909. Seeing that no definite agreement had been reached by that date, the line ceased to use the electric system, and steam trains have been operated since July 4. All the overhead wiring, poles and apparatus are now being taken down and it will not be long before all traces of the extensive electric outfit have disappeared.

Although the present decision of the Federal Railroads is much to be regretted, the work which was carried on here will have a great value from a technical standpoint, as it was fully proved that a standard gauge railroad can be operated on the single-phase 15,000-volt system, working at fifteen cycles, and this will be seen when we remark that the new Loetschberg railroad is to use the same system with scarcely any modifications. It appears that a high tension of 15,000 volts for such work was first used on a large scale on the Seebach-Wettingen line, at least in Europe. Among the first roads to use 10,000 or 15,000 volts were Swedish lines, which, however, used various voltages and did not decide to employ 15,000 volts until 1908, and also the Erie Railroad in 1907, the New York, New Haven and Hartford road and the Pennsylvania Railroad. The low frequency of fifteen cycles was used as early as 1905 on the Seebach line during the early work on the section and also on the Murnau-Oberammergau electric line. The Swedish roads changed from fifteen to twenty-five cycles in 1908. It will be noted that the first work of the kind undertaken by the Oerlikon Company was carried out in October, 1903, on a half-mile trial stretch from their works to Seebach, while the first part of the Seebach-Wettingen line was built in 1904 and commenced to operate experimentally in November, 1904.

Owing in a large measure to the success of the Seebach-Wettingen line the single-phase, 10,000 to 15,000-volt, fifteen-cycle system is being adopted as a standard on the Continent. This will be best noted by observing the new projects in Switzerland and other countries which are adopting it: In Switzerland the new Loetschberg line (recently described in our columns) which is the first standard gauge railroad in Europe to be designed from the outset as an electric railroad, and containing the great tunnel costing $8,000,000 alone, also the Wiesental railroad which lies partly in Switzerland and partly in Germany. On this latter road 10,000 volts is to be used. The Martigny-Orsieres line now being constructed will use 8,000 volts. In Germany there is the new Dessau, Bitterfeld section on the Leipzig, Magdeburg railroad, belonging to the Prusso-Hessian system, using 10,000 volts.

Since the operation of the Seebach-Wettingen line in regular public service, the three electric locomotives have furnished altogether 129,710 train-kilometers and 16,704,803 ton-kilometers gross; (long tons). The writer had occasion to visit the line during the last year, and noted the successful running of the trains with the electric locomotives. As far as the public is concerned, there is no doubt that the electric trains were preferred to the steam trains, as we find generally the case. The present information about the stopping of the electric trains was furnished us by the Oerlikon Company, but as yet the reason which led the Federal Roads to discontinue the electric system have not been made public. On the other hand, besides the Swiss lines to be operated by private firms which are mentioned above, it appears that other railroad lines or the adoption of electric trains on existing lines are now in the state of project. The reasons which led to the abandonment of the electric system on the Seebach line will certainly not hinder the development of electric traction in general in Switzerland, and in fact we have the important Loetschberg line as an example, this being the most extensive of the kind going on in Europe at present.

A problem of great interest was solved in the work on the Seebach line, namely the influence of the single-phase current on telephone lines along the railroad. That such a problem needed a solution will be seen from the fact that in the Borinage single-phase line in Belgium, started in 1905, a double overhead line was prescribed, solely for doing away with common telephone disturbances.

On the Seebach line, for nine-tenths the distance, there is run an interurban line having twenty-eight wires and lying close along the railroad. At first there were telephone disturbances from two causes, one lying in the wave form of the alternator and the second in the influence of the motor on the line current. In both cases the disturbance disappeared, on the one hand by a crossing of the telephone lines and other precautions, and on the other in the use of another type of alternator and a change in the design of the locomotive motors. A long series of tests was carried out on these occasions, and the theoretical side of the question was treated by Doctor Behn-Eschenburg.

Proposed Electrification of Boston Terminals.

Plans to bring about the electrification of both Boston railroad terminals and the suburban zone, as well as other legislation of importance, are expected by the New Haven road officials at the session of the Massachusetts Legislature which opened recently.

The matter of electrification of the South Terminal and North Terminal and a further plan that will include, it is thought, the entire Boston railroad zone has been considered by the officials of the New Haven, Boston Railroad Holding and the Boston and Maine companies.

The consideration given the subject has been carried to the extent that it is roughly estimated that to electrify the zone mentioned will involve an expenditure of between $50,000,000 and $70,000,000.

Programme of 1910 Convention of International Street and Interurban Railway Association.

The programme for the 1910 convention of the International Street and Interurban Railway Association has just been made public. This meeting will be held in Brussels on September 7 to 10, inclusive, and this date will coincide with the twenty-fifth anniversary of the establishment of the association. A list of the topics to be considered and the committees which have been asked to report on them follow:

(1) Legislation on interurban and local railways in the principal countries of Europe. Committee—C. de Burlet, general manager of the Société Nationale des Chemins de fer Vicinaux.

(2) The proper system of city extension to obtain the best tramway transportation facilities. Committee—Mr. Wattmann, manager of the municipal tramways of Cologne and an associate member from France to be appointed later.

(3) Gas, oil and other internal combustion engines. Committee—Charles Thonet, general manager of the Société d'Enterprise Générale de Travaux, Liége.

(4) Construction and maintenance of overhead lines. Committee—Mr. Otto, chief engineer of the Grosse Berliner Strassenbahn.

(5) Recent improvements in rolling stock. Committee chairmen—Messrs. Spängler, manager of the Vienna Municipal Tramways on car bodies; Delmez, chief engineer of the Antwerp Tramways, on car construction and platforms; Julius, manager of the Haarlem Electric Tramways, on equipment. The other members of the committee are Messrs. Boulle, manager of the Compagnie Générale Francaise de Tramways, Paris; d'Hoop, manager of the engineering department of the Brussels Tramway Company; Giersch, chief engineer of the Hamburg Tramways Company, Hamburg; Lineff, consulting engineer to the Moscow Corporation Tramways; Passelecq and Peiser, chief engineers of the Grosse Berliner Strassenbahn, Berlin; Résal, general manager of the Compagnie Francaise des Tramways Electriques et Omnibus of Bordeaux; Rochat, general manager of the Geneva Electric Tramways; Schmidt-Eckert, general manager of the Vienna Municipal Tramways; Stahl, manager of the Municipal Tramways of Düsseldorf; t'Serstevens, Secretary of the International Street and Interurban Railway Association.

(6) Wattmeters and other current recorders for use on cars. Committee—Messrs. Bouton, general manager of the Compagnie des Tamways de l'Est Parisien, and Battés, manager of the Frankfort-on-Main Municipal Tramways.

(7) Construction and maintenance of city track construction. Committee—Charles Rochat, general manager of the Geneva Electric Tramways, and A. Busse, chief engineer of the Grosse Berliner Strassenbahn.

(8) Rail corrugation. Chairman—A. Busse, chief engineer of the Grosse Berliner Strassenbahn. The other members of the committee are Messrs. Boulvin, general manager of the Compagnie Générale de Railways et d'Electricité, Brussels; Prof. Carus-Wilson, consulting engineer, London; Culin, chief engineer of the Hamburg Tramways; d'Hoop, manager of the engineering department of "Les Tramways Bruxellois," Brussels; Dubs, manager of the Marseilles Tramways; Fischer, manager of Phönix Rolling Mills, Ruhrort; Mariage, chief engineer of the Compagnie Générale des Omnibus, Paris; Noirfalise, general manager of the Liége Tramways; Petersen, manager of the Dortmund Municipal Tramways, and t'Serstevens, secretary of the International Street & Interurban Railway Association.

(9) Ties Committee — E. A. Ziffer, president of the Bukowina Railway, Vienna.

(10) Standard classification of accounts. Mr. Géron, manager of the Compagnie Générale des Chemins de fer secondaries, Brussels.

Electric Railways in Central Japan.

The center of Japan consists of the "original provinces," a territory of 8,000 square kilometres comprising the cities of Kioto with 400,000 inhabitants, Osaka with 1,300,000 and Kobe with 340,000 and forming the most densely populated region of the entire country. It offers therefore a good field for electric railways, especially as there are many populous communities between the large cities. The fares on the electric railways, which have only one class, are usually cheaper than those of the lower class of the state railways and this is a great attraction for the generally poor inhabitants; the longer duration of a trip is of little import to them, for time is generally not valued so highly in Japan. It is due to these conditions that a number of electric railways have come into existence or are planned in Central Japan. As the ground is still cheap and the territory offers few difficulties in construction, these railways prove quite profitable.

The Osaka-Kobe double-track electric road touches towns and villages of 138,000 inhabitants and has a length of thirty-one kilometres. The shares of this company, which have par value of fifty yen, were recently quoted at 128 yen. The Nankai electric railway, which has a length of 15.2 kilometres, connects with the towns to the southwest of that city. The entire electrical equipment for this line was furnished by an American company. Construction work on the forty-eight kilometre double-track railway between Kioto and Osaka is well advanced and is expected to be completed early in 1910. The Kobe-Akashi Electric Railway Company intends to build a road of 18.2 kilometres from Kobe through Suma to Akashi, which will facilitate communication with several popular seashore resorts. The Minomo Arina Company has planned a line of 24.8 kilometres from Osaka to Takaradzuka with a branch of four kilometres to Minomo. The latter two cities are popular Japanese health resorts.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, December 6, 1909.*

Brooklyn Rapid Transit Increases Wage Scale.

Announcement has been made by the officials of the Brooklyn Rapid Transit that an increase of wages would be given to the employes in the operation department beginning January 28. The increase is half a cent an hour in the pay of the men and will amount to five cents a day a man, and the payment of about $200,000 additional in a year by the company. Guards at present receive from twenty-one to twenty-three cents and motormen from twenty-six to thirty-one cents per hour.

Proposed Electrification for Boston.

At a recent meeting of the United Improvement Association, of Boston, Mass., it was decided to introduce a bill in the Legislature for the electrification of the railroads within ten miles of Boston. Coöperation with other organizations is planned to arouse general interest in the proposition.

Electricity Probable for Locomotive Headlights.

The Indiana Railroad Commission has issued an order requiring all railroads operating in Indiana to equip their locomotives with headlights of at least 1,500-candlepower. The order requires one-third of the locomotives to be so equipped by July 1, one-third by January 1, 1911, and the remainder by July 1, 1911. The order does not say that electric lights shall be installed, but that the present oil light is inefficient and shall be discontinued by the substitution of a high power lamp. This, of course, means electricity.

The cost of installing these lamps is estimated at $125 to $300. There are upwards of four thousand locomotives used in Indiana which will come under the order of the commission.

Chairman Wood, in announcing the order, said the commission had based its decision after long and careful experiments made by the members of the commission in riding behind both oil and electric headlights, and also, experiments made by the dean of the engineering department of Purdue University. Chairman Woods said that the best railroads in the country were installing electric lights on their engines and the commission had concluded that the objection urged by enginemen because of their blinding effect was overestimated especially since the order requires that the new power lamp to be installed shall be equipped with a device which will enable the engineman to reduce the brilliancy of the lamp at will. A large number of railroad men were present when the order was announced, and it was evident that they were greatly disappointed, but there will be no appeal from the order. S.

Minneapolis Fare Decision.

Justice Day of the Supreme Court of the United States in a recent decision held to be invalid the ordinance adopted by the City Council of the City of Minneapolis, Minn., in 1907, requiring the Minneapolis Street Railway Company to sell six tickets for twenty-five cents.

The company fought the ordinance on the ground that it was a violation of the contract implied in its charter, which, issued in 1873, was to run for fifty years, and which authorized a charge of five cents for each ride. The United States Circuit Court for the District of Minnesota declared against the ordinance, and Justice Day sustained this finding.

Central Electric Railway Association Annual Meeting.

The annual meeting of the Central Electric Railway Association will be held at the Great Southern Hotel, Columbus, Ohio, Thursday, January 27. The morning session will be held at 9:30 o'clock. The following programme has been announced:

MORNING SESSION, JANUARY 27.

Business session and reports of special committees.

"Notes on Street Paving," paper by Thos. B. McMath, Indianapolis Traction and Terminal Company, Indianapolis, Ind.

"The Daily Inspection and Up-Keep of Rolling Stock," paper by H. H. Buckman, Louisville and Northern Railway and Lighting Company, New Albany, Ind.

Adjournment for lunch.

AFTERNOON SESSION.

"The Railroad Commission and its Relation to Interurban Roads," paper by Hon. O. P. Gothlin, Railroad Commissioner, Columbus, Ohio.

"The Method of Procedure When a Person Refuses to Pay Fare for Self or Child," paper by Hon. C. C. Williams, Ex-Judge Common Pleas Court, Columbus, Ohio.

Reports of Standing Committees—Insurance, Henry N. Staats, chairman; Lightning Arresters, W. E. Rolston, chairman; Publicity, Geo. S. Davis, chairman; Standardization, T. W. Shelton, chairman; Supply Men, John F. Ohmer, chairman; Traffic, W. S. Whitney, chairman; Personal Injury Claims, E. C. Carpenter, chairman; Transportation, T. F. Grover, chairman; Vigilance and Membership, C. D. Emmons, chairman.

Annual report of secretary.

Annual address of the president.

Election of officers.

Cost of New York Subways.

Nearly $60,000,000 has been spent for subways in New York city, according to figures sent to the Tax Department by the Public Service Commission. Of this sum nearly $7,000,000 has been expended on the new loop between the East River bridges, which Comptroller Metz used to call a "hole in the ground" and which will not be put in use for some years.

The main subway, including the Brooklyn end, cost $52,254,468, including all the extensions, alterations, terminals, interest and damages.

Rehabilitation of Chicago Consolidated Traction Company.

Representatives of the security holders of the Consolidated Traction Company, otherwise known as the Yerkes system, have perfected a financial reorganization plan which contemplates an issue of first mortgage rehabilitation bonds, the amount depending upon the requirements imposed by the City Council, but estimated at $4,000,000; a consolidated or second mortgage to redeem the underlying securities of the Consolidated Traction Company, totaling $5,600,000; an issue of stock, represented by participation certificates to be exchanged for the general mortgage bonds of the Consolidated lines. These in the aggregate amount to $7,500,000. The capitalization will not exceed $100,000.

The holders of the securities of the Consolidated lines will be called upon to deposit their holdings with the reorganization committee which thereupon will open negotiations with the city council through the local transportation committee for a franchise grant.

The last and most difficult step in the rehabilitation will be taken when the United States Circuit Court, following favorable action by the city council, puts the provisions of the plan into effect and launches the United Railways Company as successor to the several lines of the far North and West sides, now fast nearing the end of a disastrous financial course.

Niagara Falls Power Company to Issue Bonds.

The Niagara Falls Power Company has applied to the up-State, New York, Public Service Commission for permission to issue $10,091,000 refunding and general mortgage gold bonds, secured by its mortgage or deed of trust for $20,000,000. The proceeds will be used to refund obligations amounting to $9,076,000, and the balance for extensions and improvements.

Lackawanna Considering Electrification.

General Superintendent Clark, of the Lackawanna, says that the road has plans under consideration for the electrification of a part of the line.

The plans call for electric power on the suburban lines and for helping freights over the steep grades about Scranton, Pa.

The company intends ultimately to make a four-track road of its main line.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

POWER HOUSE ECONOMICS IN BALTIMORE.[1]—II.

BY HORATIO A. FOSTER.

FOUNDATIONS.

As considerable trouble had been experienced with a foundation for a large reciprocating engine which had been installed previous to our taking up the work, much attention was given to this subject as it came up. The whole surface upon which the new Pratt street power station was built had been occupied by the one that was burned. This site had been piled all over its area by piles about four feet apart, the stringer pieces (twelve by twelve) had been bolted on top, two layers of planking, each four inches thick were placed over these stringer pieces, and the whole was overlaid by a foot of brick laid in cement. As the shaking of the foundation mentioned indicated that extra piling would be necessary in constructing additional foundations for the turbo-generator, for an additional 5,000-kilowatt reciprocating unit, and for the two 1,800-kilowatt, direct-current units which it was decided to place along the center of the room, the top covering of brick, plank and stringers was first removed; then the mud and silt were excavated for a depth of five feet around the existing piles and intermediate piles were driven between all the rows of those already in place. In addition two rows of sway piles were driven around the outer edge of each foundation, then concrete was filled in about the heads of all these piles, and over their tops, and upon this the superstructure of the foundation was constructed of reinforced concrete. In every case tie rods of steel, and keystones were left in the concrete, to which the adjacent foundation was tied. All these foundations were as stiff as could be desired, and no swaying of any kind has taken place since they were built.

The swaying of the first foundation constructed previous to our contract, having become dangerous through breaking of the steel rods with which it was tied to another foundation across the room, means were taken to stiffen this up and tie it to the newer and more solid structures. Temporarily rails were used for surrounding this foundation and tying it to the mate, which had been more recently constructed. This held it as steadily as could be desired. The space in front was then excavated to the silt which was in turn excavated to a depth of several feet as had been the rest. Piles were then driven between the other piles, but in this case all were driven as sway piles, one half leaning in one direction away from the shaking structure, and the other half leaning in the opposite direction. All the mud and silt was excavated about the foundation itself, and the frame of structural steel which had been used to tie this to the opposite foundation was strengthened and use with rods to still tie it to the same structure. Other frames of structural steel were built in between this foundation and its mate; all the tie rods which had been left in the later built foundations were tied in, then the whole was covered in with concrete all around to the depth of five or six feet up to the level of the new basement floor. Not the slightest vibration is now noticeable in this foundation, and the one opposite upon which is placed one of the 1,800-kilowatt direct-current units has also been stiffened by the changes, so that it also is now free from vibration.

DOCKS.

As the city was about to commence the reconstruction of the pier walls along the wharves upon which the new Pratt street power station is located, and as some trouble had been experienced from the methods of construction which had been in use, it was felt that excavating for any such form of construction would be dangerous to the stability of the power house, and, therefore, considerable time and study were given to methods of construction which would obviate these dangers while meeting all the requirements. A design was finally adopted by the harbor engineer, Mr. Lackey, which it is thought will not only serve much better as a pier, but will permit the construction of electrical conduits, and the laying of water pipes and sewers along the wharves without offering serious obstruction.

REMOVAL OF 1,800 KILOWATT, DIRECT-CURRENT GENERATORS.

The removal of the 1,800-kilowatt, direct-current generators from the street to their permanent positions entailed much thought and labor, as the supply of current which they represented could not for a minute be spared. As additional alternating supply in the shape of the 5,500-kilowatt turbo-generator was available, one of the newly ordered 1,500-kilowatt rotaries was hurried along and installed in the temporary Dugan's wharf substation, in the rear of the central power house. This furnished a supply of current quite equal to the output of one of the 1,800-kilowatt, direct-current generators, so that as soon as one was moved and connected up another could be shut down and dismantled. The installation of this extra 1,500-kilowatt rotary was of great assistance all through the period of upbuilding of the plant as it was always ready in case of trouble with any of the direct-current machines, and was only removed to its permanent location in the central substation on Lombard street after all other machinery had been in working order for some time.

CENTRAL SUBSTATION, LOMBARD, NEAR PENN STREET.

The location of a station at this point was dictated by several conditions: (1) The overloaded condition of the Druid Hill avenue substation, together with the fast growth of its load. (2) The length of feeders from that station, which gave relatively poor service at or near their ends. (3) The

1 Reprinted, by permission, from the *Journal* of the Franklin Institute, November, 1909.

great desirability of closing the Light street steampower station at an early date, owing to its lack of economy and the impossibility of bettering that economy, as no condensing water was available. (4) The relief of the direct-current load on the central power plant at Pratt street, so that the temporary substation at Dugan's wharf might be closed.

In addition to providing a much superior supply, the closing of the two stations above mentioned was expected to result in an annual saving of at least $35,000 in cost of operation.

Knowing the conditions of operation of the cars, and the load called for by each line, it is a simple mathematical problem to determine the best location of a power-supply center, but the actual location must of course be governed by availability of reasonably inexpensive real estate, and of surroundings that will not be materially damaged by the location of such a supply station nearby. The actual mathematically correct location of this station for the existing requirements was found to be just west of Paca street on Lombard, and search was made for available real estate in that immediate neighborhood, without success. As requirements change year by year, it is not necessary to stick to the exact center of load, mathematically determined, so that real-estate officials were given some leeway as to location, resulting in the final purchase of the ground upon which this new station is now located on Lombard street, just west of Penn street. The lot is 154 feet deep from Lombard street to Cider alley, and fifty-five feet wide from house line to house line, but the building has been constructed only forty-eight feet wide in order to have a clear space all around for fire protection, and to avoid any possible trouble due to vibration of machinery.

The building is of substantial brick construction on a steel frame, and has a concrete roof on steel girders; also concrete foundations and basement floor. All windows and doors have metal frames and covering, and the building is amply lighted by numerous windows in both ends and a large glass-roofed monitor running nearly the whole length of the building. The front is of attractive appearance, though of simple design in brick with light stone trimmings and a metal cornice. There is a small door at the rear opening into Cedar alley, but the main entrance is through a large door at the westerly end of the front, which opens into a recess in the floor to permit the backing in of trucks, from which machinery can be taken by the electrically operated traveling cranes. Both in this station and the new Harford road substation the cranes were put in place immediately after the completion of the steel frame of the building, so that they were available for use in the installation of all the machinery and apparatus of all kinds that was erected in these buildings.

This station is designed for an eventual equipment of eight 1,500-kilowatt rotary converters, or a total nominal output of 12,000 kilowatts.

The present equipment is being completed for five of the 1,500-kilowatt rotaries. There are three static transformers required for each rotary, or fifteen in all, and one extra transformer has been provided for use in case one of the regular lot should become disabled. All the necessary switching gear is provided, and it is felt that this station embodies all the latest and best experience in the design of such plants, being simple in design of all connections, and location of all switching gear and apparatus, so as to insure the smallest possible risk from fire, the least risk to life, and surest continuity of service together with ease of handling and control of the apparatus in service, as well as low cost of operative labor required. A goodly sized storage battery is installed and used to operate the switches in case the outside current is cut off for any cause, and further, for supplying light for the station at such times as the supply from this regular source may be stopped. The station is wired for lighting in pipe in the latest approved manner, and light for the main operating room is supplied from a number of Cooper-Hewitt mercury-vapor lamps, affording a very efficient and economical service. Two arc lamps are also suspended just below the monitor, and are so arranged as to be automatically thrown on the storage battery in case the regular lighting fails from any cause.

The City Electrical Commission which lays all electrical conduits in Baltimore constructed conduits and manholes leading to and from the building to conform to the plans of the station. The supply feeders bringing alternating current from Pratt street power station at a pressure of 13,000 volts, enter the front of the basement at the easterly side, and are conveyed through vitrified tile conduits under the floor to their various locations along that side of the building, and are connected through oil switches to the copper busbars, which are located in a brick structure laid up along the easterly wall of the basement. These busbars are there connected to the static transformers through other oil switches and allied devices. The outgoing direct-current cable for distributing the working supply of current to the trolley lines, leave the building by front and rear through a line of ducts in the basement laid along the westerly wall of the same. For the present, and until the city duct system is extended, there will be some ten feeders (cables) leaving the station through the wall immediately in the rear of the distributing or direct-current switchboard, and connecting with the overhead lines on the north side of Lombard street. The line to Curtis Bay is so long that the regular pressure of 575 volts at the station will not be sufficient at time of full load, so a large booster has been installed in one corner of the main floor.

All the studies indicate that this station will afford much relief to the whole power situation in the center of the city, and, as mentioned, save a very considerable amount in the cost of power.

(To be continued.)

Underwriters' Fittings Approved in New York.

Commissioner John H. O'Brien of the department of water supply, gas and electricity of the city of New York, announces that until further notice the devices and materials included in the list of electrical fittings as issued by the Underwriters' National Electric Association, under date of October, 1909, are authorized for use in the city of New York, subject to such additions and modifications as may be deemed necessary from time to time.

The Institution of Mining Electrical Engineers.

The recently formed Institution of Mining Electrical Engineers held its inaugural meeting at Manchester, England, on December 17, 1909, with great éclat. J. Glynn Williams, the founder of the Institution, and Robert Nelson, His Majesty's Electrical Inspector of Mines, were made the first honorary members.

CENTRAL STATIONS FOR TOWNS OF 1,000 OR 1,200 INHABITANTS.[1]—II.

BY CARYL D. HASKINS.[2]

Plant for Lighting Alone.—In communities where there is no present possibility of developing a day load and where it does not seem expedient to run a plant continuously, it will be necessary to figure on the correct installation for a plant running from sun down until, let us say, 1:00 a. m., but consideration must be given to the fact that within a few years twenty-four hours service will be demanded.

The size of the equipment for such a plant is arrived at in exactly the same way as in the case of the twenty-four hour installation, except that in this case there will be no day load, and we cannot expect to have quite as large commercial incandescent load.

The connected lighting load for a plant operating six hours a day in a town of this size usually consists of:

	Horsepower.
1200 sixteen candlepower multiple incandescent lamps = forty-eight kilowatts	64.4
Sixty sixty-watt series incandescent lamps = 3.6 kilowatts	4.83
Five arc lamps, 2.5 kilowatts	3.35

As has been stated, fifty per cent of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to midnight, therefore, the total load on the station will not exceed fifty per cent of the connected incandescent load, forty-eight kilowatts, or twenty-four kilowatts, plus 6.1 kilowatts, the arc load necessary for street lighting, or 30.1 kilowatts; this does not include ten per cent for line loss.

A plant of fifty kilowatt (67 horsepower) capacity would be of ample size to furnish this amount of energy.

The total cost of the building, including the foundation and real estate should not be more than $1,250.

LIST OF APPARATUS IN GENERATING STATION.

BOILER ROOM.

One seventy-horsepower return tubular boiler at $725	$ 725.00
Masonry	300.00
Piping, inc. connection to engine	200.00
Foundations for heater and pump	25.00
Haulage	40.00
Steel stack, 100 horsepower	135.00
Feed-water heater, 100 horsepower	125.00
Boiler feed pump, 100 horsepower	75.00
Injector	15.00
Total	$1,640.00

ENGINE ROOM.

One seventy-five-horsepower, high-speed, simple engine	$1,050.00
Foundations	50.00
Installations	95.00
One fifty-kilowatt (sixty-seven horsepower) generator	805.00
Two belts	55.00
One three and one-half-kilowatt CQ exciter	180.00
Switchboard	200.00
Constant-current transformer for station lighting	40.00
Constant-current transformer	270.00
Installation, wiring, foundation, etc.	150.00
Total	$2,895.00
Building, including real estate	1,250.00
Franchise and legal expenses	350.00
Total central-station cost	$6,135.00

These figures are conservative, and it is probable that, by careful supervision, the cost of the plant could be considerably reduced.

The method of distribution and the cost of the material required for that purpose will be practically the same as that given for the twenty-four-hour day plant in the first part of this article.

Total cost line material	$3,750.00
Total central-station cost	6,135.00
Total first cost of entire installation	$9,705.00
Ten per cent extras	970.00
Grand total	$10,675.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

OPERATING EXPENSES.

Fixed charge, including depreciation, insurance, and taxes at ten per cent	$1,067.00
Engineer's salary	720.00
Coal, 350 tons at $2.75 per ton	962.50
Oil, waste, etc.	75.00
Incidentals	125.00
Office expenses	200.00
Total operating expenses	$3,149.50
Arc lamps, $65 each	$ 325.00
Series incandescent lamps, $18	1,080.00
Com. lighting	3,080.00
Total	$4,485.00
Total operating expenses	3,149.50
Profits to be divided among stockholders	$1,336.00

This equals approximately 12.8 per cent on money invested.

When operating six hours per day at an average load of 17.5 kilowatts per hour, the output of the plant will be 115 kilowatt hours, or a total of 42,200 kilowatt hours. Dividing $3,149, the total operating expenses for the year, by this figure, we have a cost of approximately 7.5 cents per kilowatt-hour for the power generated.

The revenue from the various classes of service and the proportion of the total kilowatt-hour output represented by each may be enumerated as follows:

STREET LIGHTING (MIDNIGHT SERVICE).

The load represented by this class of service, including ten per cent for loss in transmission, is 16,600 kilowatt-hours, or approximately thirty-nine per cent of the total output.

Commercial Lighting Load.—As has been stated, the total connected lighting load in this installation will be forty-eight kilowatts, and fifty per cent of this load, or twenty-four kilowatts, will be the peak demanded by this class of service. The average load required during the period of service; *i. e.*, until 1:00 a. m., will be approximately thirty-five per cent of this peak, or 8.6 kilowatts, which amount will mean an annual consumption of 20,500 kilowatt-hours paid for at 15 cents a kilowatt-hour.

Not more than eighty per cent of the generated power will be delivered and paid for. The plant must therefore generate 25,600 kilowatt-hours per year, which allows 5,100 kilowatt-hours for line transmission and meter losses and bad-debts.

Gas Engine Plant.—As in the twenty-four-hour plant, natural gas, if it can be obtained at low rates, makes a very attractive proposition. A plant of fifty kilo-watt (sixty-seven horsepower) capacity would be of ample size.

The total cost of such a building, including the foundation and real estate, should not be more than $1,000.

LIST OF APPARATUS IN GENERATING STATION.

BOILER ROOM.

One seventy-five-horsepower gas engine, complete with fifiy-kilowatt generator	$4,000.00
Foundations	200.00
Installations	150.00
One three and one-half-kilowatt CQ exciter	150.00
Belt	10.00
Switchboard	200.00
Constant-current transformer	220.00
One two-kilowatt transformer for station lighting	30.00
Installation, wiring, foundation, etc.	160.00
Total	$5,120.00
Legal expenses	350.00
Building, including real estate	1,000.00
Line material, same as in steam plant	3,896.00
Total	$10,366.00
Ten per cent additional	1,036.00
Grand total	$11,402.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

OPERATING EXPENSES.

Fixed charge, including deperciation, insurance, and taxes at ten per cent	$1,140.00
Engineer's salary	720.00
1,200,000 feet of gas at thirty cents.	360.00

1 Reprinted, by permission, in slightly condensed form, from the *General Electric Review*, November, 1909.

2 Manager of the Lighting Department of the General Electric Company, Schenectady, N. Y.

Oil, waste, etc.	125.00
Incidentals	225.00
Office expenses	200.00
Total operating expenses	$2,770.00

INCOME.

Revenue same as from steam plant.	$4,405.00
Total operating expenses	2,770.00
Profits to be divided among stockholders	1,635.00

Equals approximately 14.5 per cent on money invested.

This is based on the assumption that gas is available at thirty cents per thousand cubic feet, and that the fuel consumption will not exceed twenty-eight cubic feet per kilowatt-hour.

Engines.—As a general proposition, it does not pay to install condensing apparatus in installations of less than 200 kilowatts, and for this reason our figures have been based upon noncondensing equipments. This, however, is largely dependent on local conditions, and in localities where condensing water may be readily obtained, and where fuel costs are comparatively high, it may often be shown that the best economy is obtained by the installation of a condensing outfit.

The question of reducing the first cost of an installation has also led to the recommendation of belted units, and while this introduces the inconvenience always attendant upon the use of belts, it is believed that this inconvenience is more than offset by the difference in cost between belted and direct connected units of this capacity.

Generators.—The generators recommended for these plants are built for belt connection to the engine and are of the alternating-current type. They are designated as three-phase revolving-field machines, and are capable of delivering twenty-five per cent more than their rated load for three hours without injurious heating.

An alternating-current machine is recommended rather than direct-current; it has all the advantages which can be found in direct-current apparatus, and, in addition, allows the use of a higher pressure or voltage, thus greatly diminishing the cost of line material and making it possible to carry current to a much greater distance than can be done with a direct-current machine. Each generator is provided with an exciter which is itself a small direct-current generator.

It may be well at this point to call attention to the fact in this day and generation, with the possibility of power steadily and rapidly developing, no consideration should be given to single-phase generating machinery, as this is entirely unsuited to power work. There is no objection whatsoever to operating three-phase machines single-phase for lighting service, but the future should never be lost sight of in providing a generating equipment for the present.

Switchboard.—The switchboard of an electrical generating station has as its primary function the same purpose as the switchyard of a railroad system: On each main track, or bus of the switchboard, are delivered the units of electrical energy from the generators, and these units are distributed through the system of wiring for lights and motors, by means of the controlling switches located upon this board. The switchboard, then, is the keynote of the station, and it is particularly important that it be provided, not only with switches, but with instruments which will show at all times the condition of the circuits, and with protective devices which will guarantee the greatest degree of safety. This is an item upon which it does not pay to economize too closely.

Transformers. — Where current is generated and distributed at 2,300 volts, it is necessary to have transformers in order to reduce this voltage low enough to be conveniently and safely carried into the buildings.

For street lighting it is necessary to use a specially designed transformer, so constructed that it will give a constant current.

Street lighting is done by means of both incandescent and arc lamps in series on the same circuit. The receptacles in which these lamps are held are so arranged that if one lamp burns out, or for any reason breaks, the others will continue to burn without injury and without difference in their light.

The street lamps may be supported by a bracket or they may be suspended in the middle of the street by wires between two poles. The method of suspension and the position of the lamps depend entirely upon the character of the foliage along the street. If the bracket method is used, it is generally found most advisable to place lamps on both sides of the street; that is, first on the right side and then on the left.

The incandescent lamps recommended for this purpose are what are known as the tungsten series lamps. These have a very low power consumption and give a brilliant white light. Each lamp is provided with a shade of sheet iron or copper so designed that it distributes the light up and down the street.

Meters.—In each building where current is used a recording wattmeter should be installed. This instrument accurately records all current which is used and may be read at intervals, and the customer charged for exactly the amount which he has consumed.

The use of meters is highly recommended instead of what is known as the flat-rate system, as they not only guarantee that the consumer pays for exactly what he gets, but also insure the company against the abuse which is so common under the flat-rate system.

The first investment in meters is small compared with the saving which they effect in the output of the plant.

Business Management.—As in any other enterprise, the success of a power plant depends largely on the progressiveness of the business management. The operation of the plant requires not only the ordinary care and intelligence given to any steam engine equipment. The electrical end is far simpler than is ofttimes imagined.

To the management falls the task of educating their public up to the uses of electricity, of obtaining customers and of keeping them satisfied.

The purposes for which current may be used may be divided into three classes: commercial lighting, street lighting, and power. Each class should be carefully investigated and developed.

Commercial Lighting.—This portion of the load demands the first and most careful attention on the part of the management. There is no question but that many people recognize the perfectly evident and obvious advantages of electricity, and are only deterred from using it by the fact that the first cost of wiring their premises is a larger outlay than they feel they can afford.

To meet this view, many managements have undertaken to wire buildings, charge only the actual cost of labor and material, plus a reasonable interest, and spread the payments for so doing over a period from three to twelve months, so that at no time is it a burden to the customer.

The cost of wiring amounts to approximately $1.50 per outlet when visible or knob and tube wiring, as it is called, is used. If concealed wiring is desired, the cost amounts to somewhere around $4.50 or $5.00 per outlet. Even if the power company itself does not care to undertake the wiring business, it is not at all unusual for a small sup-

ply and construction company to be formed, often by the same men who are interested in the power plant, which pushes this work in close co-operation with the central station.

The supply business is profitable and should be carefully considered. No mention of the revenue which should be obtained from this supply business has been made in the body of the estimates, but this should amount to, at least, $900 a year for supplies alone, exclusive of labor.

In the early days of incandescent electric lighting, it was found that considerable trouble and dissatisfaction arose among customers from using poorly made, low-efficiency, and improperly rated lamps, and still further by continuing lamps in service long after they had become blackened, dimmed and useless.

As a satisfied customer is the best possible advertisement, central-station managers have found it necessary to advise and assist their customers in the selection and proper use of lamps, and, as the price became lower, the free renewal of lamps was adopted as the simplest and most effective method of insuring satisfactory service.

All new carbon lamps, manufactured by companies of established reputation, now maintain their efficiency within reasonable limits throughout life, hence it is not as essential as formerly to insure satisfactory service. Furthermore, the new, improved high-efficiency lamps, such as tungsten lamps, are too high in first cost for free renewals, and as these lamps will supplant carbon lamps to a very large extent, it would appear that the future tendency will be more and more toward a customer paying for his renewals.

For a considerable portion of the central-station service, the cheapest as well as the best lighting can be obtained only by using tungsten lamps.

The average life of the tungsten lamp properly installed is over 800 hours. While the high cost, as compared with carbon, together with a certain percentage of accidental breakage and early burn-outs may retard its rapid introduction, consumers can in time be educated to appreciate the fact that the average result they obtain will, at a given cost for current, make tungsten lighting the cheapest as well as the best. Many central stations have assisted in the introduction of tungsten lamps, thus greatly improving their service, by furnishing these lamps on a rental basis for each lamp installed of from twenty to thirty-five cents per month, additional to the regular meter charge for current supplied.

The most satisfactory and efficient lighting service can only be obtained by continuous education of consumers as to the best and most economical lamps for the various conditions of their service and the best method of installation from an illuminating engineering standpoint.

The following table is interesting as it shows the relation between first cost and cost of burning, and it will be noted that as the cost of lamp increases, the amount of power (*i. e.*, watts) necessary to produce the light decreases, and hence the cost of burning per hour decreases in direct proportion.

Type.	Candle-power.	Watts	Price	Cost of burning lamp per hour, with current at 15c. kw. hr.
Carbon	16	56	$0.20	.0085
Carbon	32	112	.30	.017
Gem	20	50	.25	.0078
Gem	40	80	.35	.0125
Tantalum ...	12.5	25	.55	.0038
Tantalum ...	20	40	.50	.0062
Tungsten	32	40	1.50	.0062
Tungsten	48	60	1.75	.0093
Tungsten	80	100	2.00	.015

STREET LIGHTING.

This branch of the service is a steady and sure source of revenue for any lighting company. It is a matter upon which there should always be the closest co-operation between the lighting company and the board of aldermen or trustees, and they should work in harmony to determine what system will give the most efficient and satisfactory results.

Of late years there has been a great deal of investigation in connection with street-lighting systems. The general consensus of opinion is that in business streets, or in localities where there is no foliage, arc lamps should be used. They must be hung fairly high, and as there is no obstruction, the light is diffused or spread up and down the street as far as its beams will carry, giving a brilliant illumination, not only upon the streets themselves, but upon the walls of buildings where it is just as essential.

In the shaded streets of the residential sections, a brilliant illumination is neither necessary nor pleasant. Furthermore, the shade trees prevent the high hanging of lamps and the proper diffusion of the light up and down the streets. For this reason, incandescent lamps of forty or sixty candlepower, placed at frequent intervals, give a much more uniform and satisfactory distribution of the illumination.

The arc light in such streets produces areas of intense light surrounded by unlit areas which appear all the darker in comparison. It must be remembered that incandescent street lamps can be operated for about one-quarter the cost of an arc lamp, therefore, many more may be had for the same money outlay.

The rates charged for street lighting are well established in different sections of the country, varying slightly with the price of fuel, and every attempt should be made to secure a long term contract for this service.

Telegraphic Intercommunication for South American Countries.

Consul Isaac A. Manning sends from La Guaira the following information concerning the extension of telegraph lines from Venezuela to neighboring countries:

The Government of Venezuela is preparing to construct a telegraph line through the country south of the Orinoco to San Fernando de Atabapo, on the headwaters of the Manoas River near the borders of Colombia and Brazil. It is proposed, if possible, to extend this line through to a connection with the Brazilian system, and by agreement with the Brazilian and other Governments to form an international Latin-American system. The Venezuelan minister of interior relations has requested the necessary information through the minister of foreign relations and has also requested that the commission appointed to make a physical and political map of Venezuela supply him with a topographical map of the country to be traversed by the line in Venezuela.

The director of telegraph in Colombia has communicated to the director of telegraph in Venezuela that telegraphic communication direct from Caracas to the Republic of Ecuador is now established via Bogota.

Mexican Light Company to Add Capital.

A special meeting of the stockholders of the Mexican Light and Power Company has been called for January 20 to vote on increasing the preferred stock by $3,600,000 to $6,000,000 and the common stock by $5,400,000 to $19,000,000.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Saving Operating Expenses by Long-Burning Flaming Arc Lamps.

The flaming arc lamp with its unparalleled success as by far the most intense and at the same time practically cheapest source of light of the present time possesses the great disadvantage of requiring a frequent renewal of carbons. It is technically impracticable to employ carbons more than 600 to 700 millimetres in length, and these barely last sixteen to eighteen hours. On account of the high cost of the impregnated carbons and the daily attention required by the flaming arc lamp the maintenance expenses are much greater than for ordinary long-burning arc lamps, and the manufacturers should therefore endeavor to reduce these items of cost as much as possible. That efforts are being made to produce a long-burning flaming arc lamp is shown by numerous patent applications, especially in England and America. But the solution of the problem is difficult, and during the eight years that the flaming arc lamp has been on the market no successful long-burning lamp has appeared.

According to the experiments that have so far become known those occupied with the problem have attempted to reach their object by two entirely different ways, one being the development of the flaming arc lamp into a long-burning lamp with an inclosed arc, the other the employment of several pairs of carbons to be burned alternately or successively. The first way would seem to have the least prospect of success; the continuous and liberal supply of oxygen required for burning all impregnated carbons so far known and the large quantity of combustion products make it impossible to enclose the arc in a small inner globe. Success in this direction can be attained only by inventing new types of impregnated carbons that leave little or no deposit, but have the same light-increasing properties as those now employed; however, according to experience this appears to be very difficult. The second way, that of using several pairs of carbons, though it has decidedly better chances of success, offers greater mechanical difficulties, for a lamp of this type must operate with absolute reliability during the entire burning time, and the complicated construction of most flaming arc lamps is an obstacle to the attainment of this end. Only a lamp with very simple regulating mechanism will be successful, but its success would be so great also in a commercial way that the development of such a lamp is a task well worth its accomplishment.—*Abstracted from Elektrotechnischer Anzeiger, Berlin, December 2, 1909.*

Criticism of the Flicker Photometer.

While speaking a few weeks ago before the Newcastle (England) Section of the Institution of Electrical Engineers, H. Morris-Airey is reported by *The Electrical Engineer* (London) to have said that in recent years photometers of the flicker type have obtained a certain degree of prominence, it being claimed that they enable the illuminating powers of sources of light of distinctly different color to be compared with one another with an accuracy unattainable by means of photometers of the steady illumination type. But he had not been prepared to endorse this view, and from time to time it had been borne in upon him that the principle relied upon involved physiological phenomena likely to disturb true representation of illumination. So he carried out a long series of experiments, which justified his doubts. His experiments showed that the predominance of tints was due largely to the length of stimulus and its frequency. He came to the conclusion that the conditions under which the retina is excited during a measurement with the flicker photometer are not the practical conditions of illumination to which it is our object to apply the data we obtain from the experiment, therefore the whole matter of the value of this photometer for tests of differently colored light souces may require reconsideration.

TANTALUM LAMPS FOR THE LIGHTING OF SHIPS.

BY DR. ALFRED GRADENWITZ.

Electric incandescent lamps, owing to their many inherent advantages (remarkable freedom from fire risks, ease of operation, saving in the cost of attendance and repair, steadiness of light, lack of any deterioration of the air or troublesome production of heat, independence of the weather and the motion of the vessel) have been rapidly adopted for the lighting of ships, replacing all other modes of illumination.

In order to improve the electric lighting plants installed on board ship, endeavors have been made from the outset to cheapen the practical utilization of the electric current, and the adoption of metal-filament lamps and especially of tantalum lamps has been found of much assistance in this connection. This lamp, in fact, uses from thirty-five to forty-three per cent less current than ordinary carbon-filament lamps, its energy consumption being only 2.0 watts per horizontal candlepower. The tantalum lamp is of remarkably stable construction and has been found far less sensitive to shocks and vibrations than any other illuminant with metal filaments. In contrast to some incandescent lamps of recent invention, it is not limited to a vertical position, but can be suspended in any direction. It is made in all of the usual sizes, such as sixteen, twenty-five, thirty-two and fifty candlepower, besides larger and smaller sizes for special locations. For the lighting of dining, drawing and sitting rooms lamps with frosted or tip-frosted pear-shaped or spherical bulbs should be adopted, whereas in the case of other rooms on board ship only pear-shaped bulbs can be used, which are readily fitted into any lamp socket used in connection with ordinary incandescent lamps.

This metal-filament lamp readily takes care of the increased requirements of the most exacting passengers

for a luxurious lighting of comfortable saloons, without necessitating any extra cost as against the former less abundant mode of lighting, no extension of machinery being required because of the reduction in the consumption of energy as against carbon-filament lamps. It also complies with any exigencies of an artistic taste, being mounted in elegant metal sockets or majolica fittings, which latter, being made of pottery, are not subject to the influence of the salt sea air and atmospheric conditions. Being readily adapted to the architecture and decorative scheme,

FIRST CLASS DINING ROOM ON ONE OF THE GERMAN OCEAN LINERS ILLUMINATED BY TANTALUM LAMPS.

stairways, vestibules and saloons, tantalum lamps may be said to form an adornment of any ship room, as is shown by the accompanying illustrations. Some of the new majolica fittings which are finding special favor are shown herewith as supplied to German vessels.

The main advantage of tantalum lamps, according to the above, consists of their low consumption of energy. On a large number of vessels, especially those of the North German Lloyd and the Hamburg-American Line, many types of tantalum lamps have been installed for the last few years, giving most remarkable results in regard to energy consumption. On board the tourist yacht *Oceana* of the Hamburg-American Line, the advantages inherent to tantalum lamps made themselves strikingly manifest during the last Kiel regatta week. Whereas the shipping company, in order to provide for the increased consumption of energy for illumination, was formerly compelled to install a special machine on board that ship, this, in spite of most extensive illumination arrangements, could this time be dispensed with owing to the use of tantalum lamps.

All experience goes to show that tantalum lamps are not damaged in any way by the vibrations of the ship. Those which have been installed on small ferry steamers, harbor tubs, etc., in spite of the many shocks imparted to such vessels, especially on touching the shore, have not undergone any deterioration from this cause. The fact that tantalum lamps are being used to a considerable extent also by the German Navy proves their ability to withstand even the enormous vibrations of the hull that are produced by the firing of heavy guns.

The following figures, which have been derived from experiments made on board the steamship *Graf Waldersee*, strikingly illustrate the considerable saving of coal likely to be obtained by the adoption of tantalum lamps, in spite of the increased cost resulting from the replacing of the lamps, which, by the way, is covered after a few hundred hours:

Saving in energy per year	160,200 kw.-hours
Coal consumption per kw.-hour	7.25 pounds
Saving in coal per annum	1,163,052 pounds
Saving in cost of coal per annum	$2,283
Excess cost of tantalum lamps per annum as compared with carbon-filament lamps with a 1,000-hours' life of each lamp	1,390
Total saving per annum in the case of tantalum lamps	$893

The following items have not been taken into account in the above table:

Saving in lubricating material for the machinery, saving in the cost of repairs, and cost of superintendence of the machinery (only one or two machines being worked instead of three machines as theretofore). However, this saving may be said to be in reality even higher, as the average life of tantalum lamps has been found to be upwards of 1,000 hours. Taking the maximum number of lamps to be replaced (corresponding to actual tests) at eight per day (as against fourteen according to the above figures), the

total saving per annum will be seen to increase to about $1,248.

In the case of new ship-lighting plants, which are designed from the outset for the use of tantalum lamps, the size of the machinery, in accordance with the reduction in current consumption, ensured by tantalum lamps, can be made less than in the case of ordinary carbon-filament incandescent lamps. The saving secured in the purchase of the machinery then works out at about $480 in the case of 250 tantalum lamps of sixteen candlepower, and at $1,080 in the case of 1,000 lamps of twenty-five candlepower each.

The reduction of the current consumption obviously results in a considerable cheapening in the cost of installation of the switchgear and cables, so that in spite of the higher first cost of tantalum lamps, the total saving according to actual conditions, will work out at up to twenty per cent of the total cost. To this initial saving should be added the annual saving of coal, lubricating and polishing materials, and the reduction in the cost of repairs and maintenance, while the crew required for superintendence is far less numerous.

A speed of 180 words a minute (five letters and one space per word) was recently attained with the Murray automatic page-printing telegraph, from London (Eng.) to Glasgow.

WHITE LIGHT FROM THE MERCURY ARC AND ITS COMPLEMENTARY.[1]

BY HERBERT E. IVES.

Attempts have been made to modify the color and illuminating characteristics of the mercury vacuum arc by the addition of yellower light sources. The first light used for this purpose was the carbon glow lamp. More recently the use of a tungsten lamp has been proposed.

In the present paper is recorded an experimental investigation of the proper light source to be combined with the mercury arc in order to imitate average daylight, following which is a determination of the relative intensities of mercury arc light and the added light to secure the best effect.

The complementary of the mercury arc may be determined by direct application of color theory to experimentally obtained color values, as for instance, spectrophotometer data. First, find the spectrum hue of the mercury arc; secondly, find the complementary hue, or hue to be added to produce white; then select a light having that dominant hue. From the color-sensation values of the two sources, and the intensity values of the sensations, the candlepower relations of the two to give white are calculable. On carrying through this work, the rather unexpected result was obtained that the best combination was of the mercury arc with a Welsbach; unexpected, because the usual criticism of both illuminants is on the ground of their green color, or illuminating effect.

In the present investigation, a method similar in principle to the above-outlined theoretical discussion was used, differing from it, however, in that it affords an opportunity to make an exact experimental comparison of the combination decided upon with the standard white it is desired to imitate. The Ives colorimeter was employed, together with Maxwell's color triangle.

The Ives colorimeter, designed by Frederic E. Ives, is essentially a color-mixing machine, mixing red, green, and blue light to produce a visual match with the color measured. White being taken as equal parts red, green, and blue, other colors are numerically described by the proportionate parts of the three primaries which mix to match them. Various light sources have been measured by the writer, among them daylight of various qualities, and the artificial illuminants compared with the average of the daylight measurements as a standard. By means of several of the illuminants which were measured in that investigation it is possible, at

1 Abstract of an article in the *Bulletin* of the Bureau of Standards, Washington, D. C., November, 1909.

Light Shaft.

Ladies' Parlor.

VIEWS IN A GERMAN OCEAN LINER ILLUMINATED BY TANTALUM LAMPS.

VARIOUS TYPES OF MAJOLICA CEILING ROSETTES USED WITH TANTALUM LAMPS FOR THE LIGHTING OF MANY GERMAN VESSELS.

any time, to determine the setting of the instrument to give "average daylight," and then compare any artificial white light with it. This possibility made available a verification of the correctness of the work here outlined; had there been no more scientific method of attaining the end, a purely experimental mixing of various sources could have been tried and the best mixture selected.

As stated above, use was made of Maxwell's color triangle to guide the proper selection of a complementary to the mercury arc. An interesting fact brought out by the color triangle diagram is that all of the ordinary light sources, from the 3.1-watt carbon lamp to the "greenest" Welsbach (one-fourth per cent cerium), lie so nearly opposite the mercury arc that a respectable white may be produced by mixing any one of them with it in the proper proportion. The light lying most nearly opposite the mercury arc is the Welsbach mantle, as supplied for residential lighting, viz., three-fourths per cent cerium; of the glow lamps the tungsten is nearest the ideal complementary.

The results obtained from the diagram were checked experimentally for the three cases considered of most interest—the Welsbach, the tungsten, and the 3.1-watt carbon lamp. The first two not only come the nearest to the proper hue, but because of their efficiency and cheapness are distinctly practical possibilities. A Cooper Hewitt lamp was provided with an adjustable cardboard shutter so that more or less mercury light could illuminate the plane of measurement. The Welsbach and the glow lamps were placed, in succession, directly before the tube and immediately below the opening in the shutter. In this way it was possible to vary the mixing proportions at will. The colorimeter was adjusted by measurements on glow lamps of known color values, so that one-half its field showed "average daylight," then the shutter over the mercury tube was raised or lowered (intensity match being preserved by opening or closing the comparison slit of the colorimeter) until the nearest match was found. With the Welsbach and tungsten it was found possible to obtain an extremely close match, the Welsbach match tending slightly toward green and the tungsten toward pink, but by such small amounts that the slight differences of adjustment in several such experiments made at one time one and at another time the other mixture appear a perfect match with the standard. The carbon glow lamp formed, with the mercury arc light, a decidedly pinkish mixture. The indications of the color triangle were therefore entirely borne out.

Several points in connection with the character of this composite white light should be emphasized. It must not be forgotten that daylight is extremely variable in color, and that the combination of lights here investigated can only claim to be a more definite guide than has hitherto been given to the proportions for a match of the integral color to an average daylight. Further, it is, of course, only the integral color that appears white to the eye; analysis reveals the mercury line spectrum superposed on a continuous background strongest in the red. Because of the partly noncontinuous character of the spectrum of such a compound light, we must expect some deficiencies when it is used as an illuminant of colored objects.

The chief defect of the mercury arc alone — its entire deficiency in red — should, however, be largely overcome. Because of the peculiarity of the eye that it quickly adapts its scale of color values to the color of the illuminant, it is much more important, in the writer's opinion, that the illuminant should preserve certain color values to which the eye is particularly sensitive than that its integral color should be a perfect subjective white. In other words, the eye quickly adjusts itself to the belief that a light is "white" even if the light is measurably yellower or pinker than a standard such as average daylight or sunlight, but rebels at a distortion of its new scale of color values. Therefore our preference should be given to that illuminant of this character which favors preservation of color values to which the eye is particularly sensitive, such as the color of flesh, lips, and other commonly observed objects.

The combinations under discussion were investigated for their color rendering values by observing their effect on various colored silks, plaids, colored prints, flesh, etc. The color values were, on the whole, found to be very well preserved; immeasurably more so than with the mercury arc alone, and much better for blues than with the yellower sources alone. A slight accentuation of purples and a graying of very deep reds was observable with both combinations (Welsbach and tungsten), but ordinary reds, browns, yellows, greens, and blues appeared normal. The tungsten lamp, with its larger proportion of deep red, is appreciably better in this combination than is the Welsbach, judged by this criterion.

For the best results in color rendering, apart from the integral color of the mixture, a larger proportion of the tungsten light rather than a smaller might be recommended, because, as remarked above, the resultant pinkish character of the white would be less noticed by the eye than the disturbance of the scale of color values which occurs with a deficiency of continuous spectrum background. The behavior of the carbon lamp is similar to the tungsten, although the integral color is too pink to be called a good white.

The results of the above investigation are as follows: The Welsbach and the tungsten glow lamp are shown to be most nearly complementary in color, of the ordinary illuminants, to the mercury arc; the proportions in which their light should be added to the light of the mercury arc to produce white are determined; study of the color rendering values of the resultant mixtures indicates that the tungsten combination is the more desirable, and that the proportions given may be considered a lower limit to the amount of tungsten light to be added for satisfactory illumination of colored objects. The carbon glow lamp is also investigated and compared with the others in this combination.

An approximate idea of the efficiency of the combination of mercury arc and glow lamps is easily obtained. For the tungsten lamp combination we find, assuming 1.25 watts per candlepower for tungsten and 0.55 watts per candlepower for the Cooper Hewitt, that 1.54 candlepower is obtained at an expenditure of 1.22 watts, or an efficiency of 0.80 watts per candlepower. For the 3.1 carbon lamp we obtain, similarly, 1.4 watts per candlepower. Therefore the tungsten-mercury combination is not only nearer white, but much more efficient than the carbon lamp combination used at first. The Welsbach-mercury combination can not be expressed in this way, but consideration of expense makes this combination compare closely with the mercury-tungsten one.

TELEGRAPHY—TELEPHONY, and WIRELESS.

The Thorne-Baker System of Telautography.

Some further developments of the Thorne-Baker telectrograph, a description of which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for January 1, 1910, appear in a recent issue of the London (England) *Electrician*, from which the following is taken:

Mr. Baker is at present experimenting with the wireless arrangement shown in Fig. 1, which has given the most promise of success so far, though he is working out some modifications of it which entirely change its character. D_1 is the sending drum, with style. The current interruptions actuate a relay, M, which switches on the primary P of an induction coil; S, the secondary, is connected foil, F, one-sixtieth of an inch square, attached to two silver wires, each of one-thousandth of an inch in thickness, stretched between W, W. MM are the poles of the magnet employed, through which a hole has been bored, while L is a lens which casts a real image of F upon the slit T of a cinematograph camera. Behind this slit the sensitive film PQ is wound in the usual way. D is the metal drum on which is the halftone photograph on lead foil; S is an iridium tracer traveling laterally, so that it moves spirally over the photograph; B is a battery and K a variable capacity.

When $K=O$, with a battery of voltage V, the shutter F is laterally displaced by an amount approximately kv/r, where k is a constant, and the slit T is illuminated by a corresponding

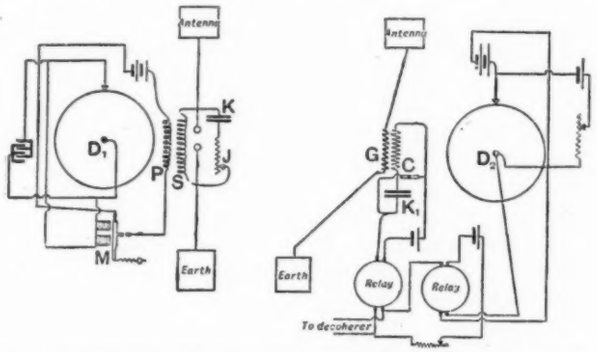


FIG. 1. WIRELESS ARRANGEMENT FOR THORNE-BAKER EXPERIMENTS IN PHOTOTELEGRAPHY.

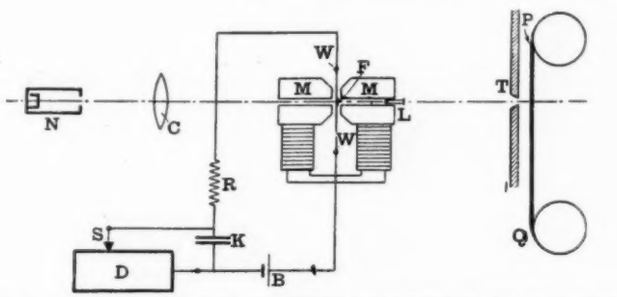


FIG. 2. APPARATUS FOR INVESTIGATING EFFECT OF CAPACITY IN PHOTOTELEGRAPHY.

by the spark gap, capacity K and inductance J. In the receiver, G is the jig, C the coherer, K_1 the jig capacity; and the first relay, besides actuating the decoherer, actuates a second relay connected through a resistance. This relay switches on the current, which produces a black dot on the paper attached to the receiving drum, D_2. The decoherer is of special design and works with great rapidity.

A diagram of an apparatus with which Mr. Baker is investigating the effects of capacity, etc., on telegraphed pictures, is shown in Fig. 2. N is a Nernst lamp, whose rays are concentrated by the lens C to a focus on a shutter of magnesium amount. Hence the interruptions caused in the flow of the current by the gum lines of the halftone photographs on D are represented on the film by tooth-like marks of width depending on the width of the corresponding lines in the photograph. These records are distorted by introducing much capacity in the circuits, but the distortion can be counteracted by the "balancer" described in the previous account referred to above.

Grand Opera by Wireless.

Beginning Wednesday night, January 12, the operas at the Metropolitan Opera House, New York city, will be transmitted by wireless telephony to those desirous of making the necessary arrangements.

A wireless outfit has been arranged behind and above the stage, so as to catch every note in the piece and to transmit it through the ether. On Saturday night, January 8, preliminary tests were made with regular wire telephones, and many persons in New York in their homes uptown heard Caruso sing in "La Gioconda."

New Wireless Station in Germany.

George A. Makinson, American consular agent at Sorau, reports that a station for wireless telegraphy and telephony has recently been erected at Eberswalde, Germany, by the C. Lorenz Telegraph Construction Company, of Berlin.

The station consists of a wooden mast seventy metres (229.7 feet) in height, to the top of which the antennas are attached. In the ground a large wide-meshed net has been sunk to the water level. The plant includes dwellings for the engineers and other employes, and also a laboratory fitted with modern apparatus and measuring instruments. The main system used is that of Poulsen-Lorenz with continuous unchecked vibrations, but communication may be had with stations equipped with other systems. It is estimated that the sphere of action will be about 5,000 kilometres (3,107 miles). Initial tests have been satisfactory.

An Experimental Method of Efficiency Determination of Wireless Plants.

At a recent meeting in London, England, of the Institution of Electrical Engineers, Dr. W. H. Eccles and A. J. Makower described the results of experiments made to determine the efficiency of a wireless plant employing a short spark discharger of the type used by Lepel. This comprises two parallel surfaced copper plates between which the discharge passes, and which form the opposed faces of two metal boxes, as shown in the illustrations.

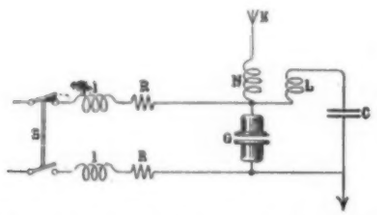


FIG. 1. CIRCUIT CONNECTIONS FOR SIGNALING.

These boxes are cooled by water flowing through them, and the surfaces are kept apart by one or two paper rings of a thickness depending on the voltage and the current required.

For the purposes of wireless signaling, the discharger is connected as shown in Fig. 1, in which *I I* represent choking coils, *R R* regulating resistances, and *S* the main switch. The primary oscillating circuit is formed by the inductance *L* and the capacity *C*, and the secondary circuit by the aerial conductor whose

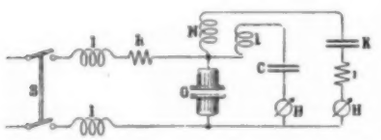


FIG. 2. CIRCUIT CONNECTIONS FOR MEASURING EFFICIENCY.

capacity to earth is *K*, the inductances *N* and *L*, and the condenser *C*. The last-named path must be tuned by trial to the oscillating circuit *L G C*. The secondary is associated with the primary, first, by the direct coupling at *G*, and secondly by the mutual inductance coupling between *N* and *L*. The primary condenser must be of considerable capacity, for the supply pressure is usually of the order of 500 volts. Only a fraction of the total energy taken from the supply circuit is received at the gap terminals, and only a fraction of this again will be received into the secondary circuit or aerial. Of this last portion some will be wasted ohmically, but most will be dissipated in the form of radiant energy.

As there is no direct way of measuring the energy radiated from an aerial wire, the authors used a special resistance instead of an aerial for dissipating the energy, it being known that the energy radiated from an aerial can be represented by the heat generated in a series resistance of from thirty to sixty ohms. The resistance possessed a high-frequency value of nearly forty ohms; it was connected in the secondary circuit as shown in Fig. 2 at *r*. The capacity of the aerial was at the same time replaced by an air condenser *K*. *H* and H^1 are hot-wire ammeters used merely as indicators. The resistance *r* was placed in a small calorimeter containing paraffin oil and provided with a stirrer and delicate thermometer. The ballast resistance *R* in the main circuit consisted of Eureka wire wound on a frame, and placed in a calorimeter containing paraffin oil. The calorimeters enabled the energy passed on to the secondary circuit as electrical oscillations and the heat wasted in the ballast resistance to be measured simultaneously. The heat wasted in the arc was measured by taking the difference between the temperature of the water flowing in and that flowing out. The electrical dimensions of the apparatus were: L=8.0 microhenries; N=171 microhenries; C =0.041 microfarads; K=0.0019 microfarads. *r* had a high-frequency value of thirty-eight ohms and a negligible inductance. *R* was given different values. The supply voltage was 500 volts. The frequency of the oscillations was 294,000 cycles a second, and therefore the wave length was 1,020 metres.

The efficiencies obtained, excluding the losses in the ballast resistance *R*, were from thirty-five to forty-nine per cent, while the overall efficiencies, including the ballast resistance losses, varied between 4.6 and 14.4 per cent. The values become lower the greater the current. This was perhaps due to the difficulty that was experienced in keeping the arc in an active condition throughout a run. The difficulty was overcome by rotating one of the electrodes as soon as the oscillations showed signs of dying out.

Acknowledgement is due to *Electrical Engineering*, of London, England, from which the above account and diagrams were reproduced. The paper gave rise to an animated discussion.

Portable Wireless Outfit Receives Without Aerial.

A recent newspaper report from New York states that a remarkable demonstration was made on January 9 last in the editorial rooms of the New York *World* by E. N. Pickerell, manager of the Waldorf-Astoria wireless station.

It is stated that Mr. Pickerell has proved by a series of experiments during several years past, that the high aerial is not a necessary adjunct of a wireless receiving station. To prove his theory to the *World* editors, he connected up his apparatus, which was contained in a leather receptacle of small size, to a typewriter, and used for a "ground" a near-by steam radiator.

The test prescribed by one of the *World* editors was the receiving of a predetermined message, unknown previously to the demonstrator, from the offices of the wireless company at 42 Broadway, which was successfully done.

"Almost anything will do," Mr. Pickerill declared. "At home I use the frame of my bed. Out of doors I use an umbrella hanging over my arm. I purpose putting a coil in my hat and affixing the telephone receivers so that they will hardly be noticeable, and I will get messages just as effectively as if I had the highest priced apparatus in the world. In warfare all a detachment needs to do is to send up a kite with a fine aluminum wire in place of string, and with the portable apparatus the men would always be under the general's command."

Asked over how great a distance he had tested his new receiver, Mr. Pickerill said he had spoken through it with Vera Cruz, Mexico, and Colon, Panama, both more than 2,000 miles away, and as to obstructions, he had messages from Colorado Springs to Cripple Creek, which had the great Pike's peak, 14,147 feet high, between them.

Telephone Properties Ordered Sold.

Judge Evans, in the Federal Court at Louisville, Ky., has ordered the sale of the Paducah Home Telephone Company and the Kentucky-Indiana Telephone and Telegraph Company of Owensboro, Ky., to satisfy creditors. J. D. Powers was appointed special commissioner, and will appoint the time of the sales. The mortgage indebtedness of the Paducah company is $250,000 and of the Kentucky-Indiana company $162,000.

Proposed Wireless Control of Seas.

A recent report from Washington quotes Chief Willis L. Moore, of the United States Weather Bureau, in a contribution of his to the House Committee on Agriculture, as follows:

"When all the nations of the earth agree upon one central, autocratic wireless station that shall have complete power over the whole Atlantic Ocean to determine when vessels in certain portions of the ocean shall send, and when they shall keep quiet, it will be possible to get a weather map of the ocean and to transmit and receive messages to and from any part of the ocean.

"It may be possible some time to make a weather map for commercial use, so that vessels can avoid storms, when all vessels of a certain size are equipped with instruments and are under international agreement that shall compel each vessel to receive and transmit observations from other vessels. But that international agreement, I think, never will come. Think of the wonderful strategic importance to the nation that controls that powerful transmitting station in case of war. It must be powerful and potential enough to send its waves over all the ocean and obliterate all other transmitters. But I fear that what is coming on the ocean is a babel of voices that cannot be heard with wireless."

A New Wireless Telegraph Receiver.

The new radiotelegraphic receiver invented by Prof. A. G. Rossi, of Turin, is based on the phenomenon of torsion produced under the influence of magnetostriction, which was discovered by Wiedemann. The sensitive organ affected directly by electromagnetic waves performs movements of great amplitude, which permit the optical registration of Morse signals by means of a mirror without the intervention of a relay. The sensitive organ is a thin iron wire, about ten millimetres long and weighing only one-half milligramme, which has a natural period of vibration of the order of hundredths of seconds and transforms the energy of the electromagnetic waves directly into mechanical vibrations. The sensitiveness of the apparatus is so great that it may serve for demonstrating a phenomenon long foreseen by theory, namely, that of the variable convection current under the influence of a moving electric charge, and for this reason it has been named "convector."

Independent Telephones in Chicago.

On the authority of President Frisble, of the Illinois Tunnel Company, particulars of the arrangements made with the independent telephone interest for entrance into Chicago have been announced. It is stated that $5,000,000 will be expended at the outset. The Tunnel receivers have been at work on the project ever since taking over the property, have been investigating the independent systems of other cities, and have decided that such an undertaking would prove a profitable enterprise in Chicago.

The New York members of the reorganization committee, representing the Eastern, Armour and Harriman interests were due to arrive in Chicago Thursday, January 13, to discuss the final details of the system. Already negotiations are pending with the Stromberg-Carlson Company, of Rochester, N. Y., and the Dean-Kellogg Company, of Cleveland, for the necessary equipment for 20,000 local telephones.

It is stated also that the rates would be considerably lower than now obtained. As soon as the first twenty thousand telephones are installed arrangements struction of the plant the transportation will be made with the Kinlock Telephone Company, of St. Louis, and the independent systems of Milwaukee, Minneapolis, St. Louis and Kansas City whereby a lower rate can be had on long-distance messages to these cities.

It is announced that the Illinois Tunnel Company will use its old franchise in bringing independent telephones into Chicago. The receivers of the Illinois Tunnel Company who will promote the independent telephone company are C. O. Frisbie, David F. Forgan and Charles C. Dawes.

Wireless Company Loses Case.

The United States Circuit Court of Appeals has affirmed a decision of the Circuit Court disallowing a claim of the Massie Wireless Telegraph Company against the Enterprise Transportation Company of which H. R. Bailey is receiver. The transportation company owned the steamship *Kennebec* which was equipped with a wireless plant. Under a decree of the court the receiver sold the steamship which the purchaser took with the wireless equipment. Under a contract between the wireless company and the transportation company for the installation of the wireless plant on the steamship, it was provided that in the event of a total loss or decompany should pay the wireless company $1,000, and for an unauthorized removal or detention of the plant $50 a month should be paid.

The wireless company claimed that by the sale of the steamship with the wireless equipment, there was a total loss of the plant or an unauthorized detention of it. The Court holds the contract did not contemplate such a construction of the words "wholly lost" or "unauthorized detention" as to include a sale of the steamship with the plant on it which the purchasers took because the wireless company did not take possession of it.

First Wireless Message Between Baltimore and Chicago.

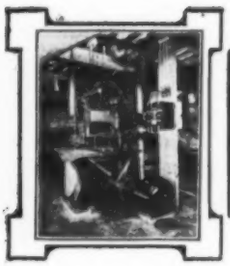
The first wireless message between Baltimore and Chicago was sent a short time ago, with J. C. Pannill in charge of the Baltimore station, and F. C. Anderson located at the Chicago end of the "line." This is said to be the first successful wireless communication between the two cities named, since the wireless came into existence; a satisfactory ground circuit made the transmission of the messages possible, and an exchange of talk was kept up for several hours. It is claimed that this is equivalent to sending a wireless across the Atlantic. Mr. Anderson is manager of the Great Lake Division of the United Wireless Company. L.

Postal Telegraph Business Good.

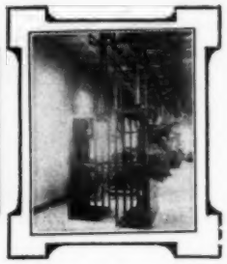
One of the officials of the Postal Telegraph Company recently made the statement that business had been better during the past few months than ever before. In speaking of the recent combine of the Western Union and American Telegraph and Telephone companies, he said that as yet this had had but little effect on the Postal Telegraph Company.

Utilities Board for Ohio.

At the seventy-eighth General Assembly of the State of Ohio, which began on January 3, last, Speaker Mooney advocated a public utilities commission on the line of the New York body, and also declared for an ample appropriation for a thorough and open investigation of all State officers. He also recommended an amendment of the laws as regards the taxation of corporations. This programme is understood to have been recently sanctioned by President Taft.



Industrial Power



ELECTRICALLY-DRIVEN PUMPS. II.

OPINIONS, EXPERIENCES AND PRACTICE OF MANUFACTURERS AND USERS.

A LARGE MINE PUMPING INSTALLATION.

In order to handle the considerable flow of hot water encountered in reopening the Ward mine, at Virginia City, Nevada, the shaft of which reaches an extreme depth of 2,480 feet, a very complete temporary system of electric pumps was installed, in addition to the permanent equipment which has a total capacity of delivering 3,200 gallons per minute against a head of 1,550 feet.

On the 2,100-foot level a six and

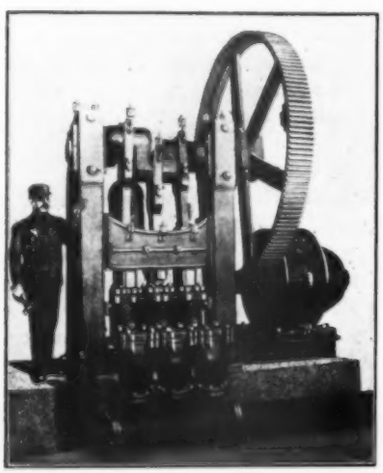


FIG. 6.—WESTINGHOUSE TYPE S MOTOR DRIVING ALDRICH PUMP.

three-quarter by eight-inch Knowles vertical triplex pump, geared to a 100-horsepower type C Westinghouse induction motor, was placed and arranged to take its water from a three-step Byron Jackson centrifugal pump belted to a fifty-horsepower Westinghouse induction motor, located on the 2,330-foot level. In turn, this centrifugal received its supply from a nine-inch Blake sinking pump at the bottom of the shaft. Two 100-horsepower Ingersoll Sergeant compound air compressors driven by two 100-horsepower Westinghouse motors in operation on the surface, supplied this sinker wth the necessary motive power. This temporary plant raising 300 gallons per minute 855 feet, from the present sump to the Sutro tunnel level.

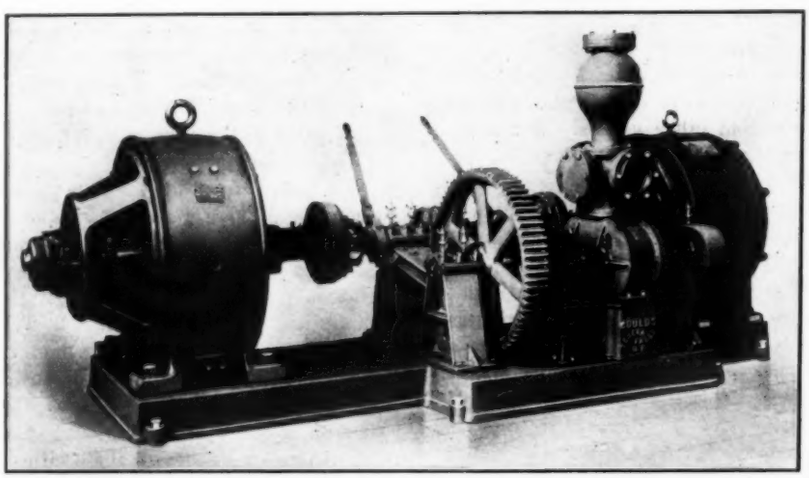


FIG. 7.—GOULDS PUMP DRIVEN BY 100-HORSEPOWER TYPE S WESTINGHOUSE MOTOR, THROUGH FRICTION CLUTCHES.

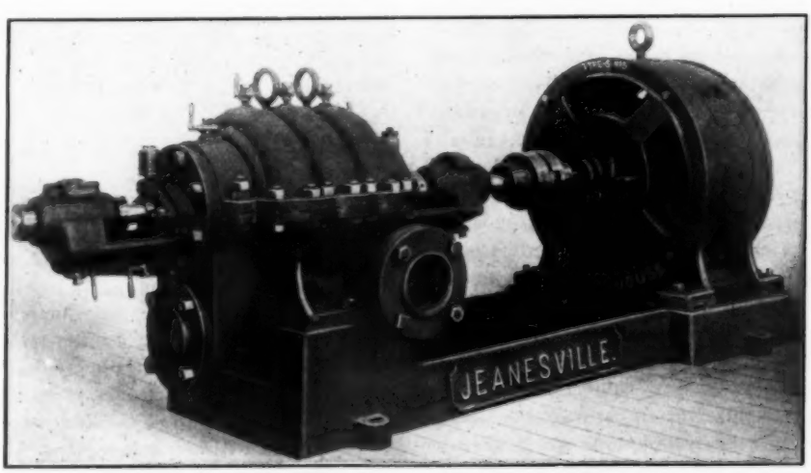


FIG. 8.—WESTINGHOUSE TYPE S MOTOR DRIVING JEANESVILLE PUMP.

In order to supplement this plant, a five-step Byron Jackson centrifugal pump, directly connected to a special Westinghouse induction motor, was installed on the 2,410-foot level. This pump has a capacity of 600 gallons per minute against a head of 900 feet and takes its supply of water directly from the sinking pump. This pump is entirely of bronze, operates at 1,700 revolutions per minute, and under these conditions shows an efficiency of sixty-seven per cent with the water temperature 160 degrees Fahrenheit. This pump has been duplicated for safety of operation.

On the 3,100-foot level the excavaton of a pump station eighty feet long, twenty-four fet wide and twenty feet high has been made, in which it placed

the permanent pumping plant, the real subject of ths sketch.

The capacity of this permanent installation will be 3,200 United States gallons per minute against a total head of 1,550 feet, and will be divided be-

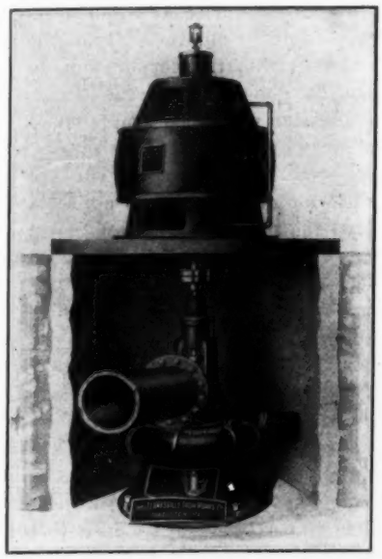


FIG. 9.—VERTICAL, TYPE S, WESTINGHOUSE MOTOR DRIVING JEANESVILLE PUMP.

tween two units each separately driven by a special slow-speed 800-horsepower Westinghouse induction motor. The pumps are of the Knowles express type and are the embodiment of all of the best mechanical and electrical ideas for this class of work. They are outside end-packed duplex double-acting pumps

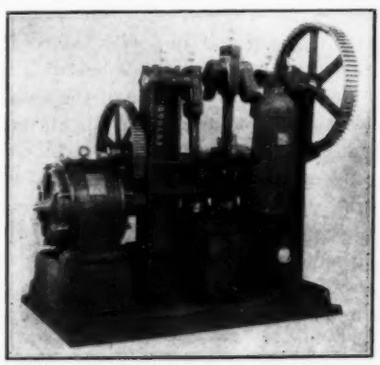


FIG. 10.—WESTINGHOUSE ALTERNATING-CURRENT TYPE C MOTOR DRIVING GOULDS PUMP.

with plungers six and eleven-sixteenth inches in diameter and fifteen-inch stroke. The rotating element of the motor is placed directly on the crankshaft and they will operate at 185 revolutions per minute.

The valves are automatic poppet valves arranged in nests of thirteen each. The valve area (103.35 square inches) is unusually large, so that the consequent movement of the valves is extremely small, all of which is conducive to a high rotative speed with a minimum of wear. The valves, stuffing box glands and other vital parts exposed to the action of the water are of bronze and are arranged so that they may be readily renewed.

The plant will be equipped with a three-stage electrically-driven air-compressor for charging the air receivers, a vacuum pump and an automatic oiling system. For convenience of erection and repair, the pump station will be fitted with a fifteen-ton traveling crane; in fact, it is intended to include in this plant everything that will insure reliability and ease of operation.

The overall dimensions of each pump are twenty-seven feet three and three-quarter inches in length, seventeen feet in width, and fourteen feet two and one-half inches in height. The motor is thirteen inches in diameter and the steel crank shaft, forged from one piece, is thirteen and three-fourths inches in diameter and fourteen feet four and one-half inches long. The total cost complete for operation will be about $125,000. These pumps will be supplied by either one of the two centrifugals located in the sump at the bottom of the shaft and operated by special seventy-five-horsepower Westinghouse motors on a vertical shaft.

The water will be discharged through sixteen-inch O. D. steel column with welded steel flanges. The thickness of this pipe varies from one-fourth inch at the tunnel level to nine-sixteenths of an inch at the bottom. The column will be supported by means of heavy iron clamps six inches in length, which in turn, will rest upon the wall and end plates. To resist the pressure of 675 pounds to the square inch, male and female flanges are used and each fitted with a lead-filled copper casket.

The electric current is taken down the shaft at 2,240 volts over a three-conductor lead-covered steel-armored cable. The electric equipment from the automatic, oil circuit-breakers on the surface to the motors themselves is the best that money can buy, so that once in operation, with the splendid Westinghouse plants of the Truckee River General Electric Company behind it, results are anticipated that have never before been approachd for this class of work.

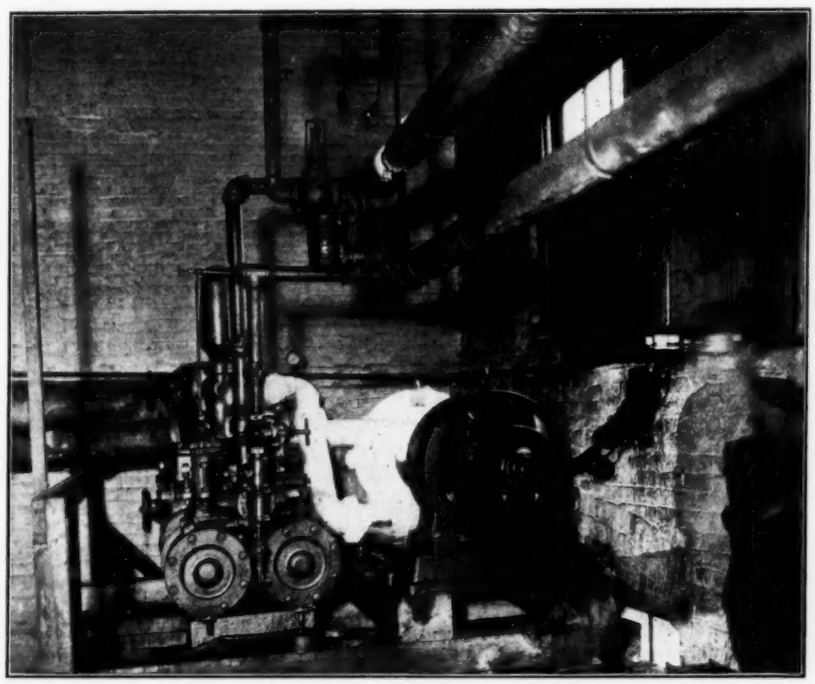


FIG. 11.—WESTINGHOUSE TYPE S MOTOR DRIVING DAYTON CENTRIFUGAL PUMP.

Illustrations for this sketch were not available at the time of writing, but several typical pumps fitted with Westinghouse motors are shown, as being typical examples of some recent electric-pumping practice.

(To be continued.)

Electric Pumping in New Zealand.

Mining Inspector F. Reed, of the New Zealand Mines Department, in his annual report for 1908, gives several instances of the use of electric pumps in his territory. Among particular cases he instances may be mentioned the following: The Waihi Grand Junction mine has installed Sulzer vertical three-stage pumps (estimated height to be pumped 250 feet, capacity in gallons per minute 666); the Waihi G. M. Company three-throw ram (height 600 feet, gallons per minute 1,500); Barewood G. M. Company, three-throw ram (height 600 feet); New Zealand Crown Mines, duplex ram (two units; height 1,000 feet in two stages, gallons per minute 1,135); Ross Goldfields (alluvial, multi-stage Worthington turbine, four units, height 400 feet, gallons per minute 3,500.

These particulars are culled from a recent issue of the London (Eng.) *Electrician*.

Pumping Practice in the United States.[1]

In the United States, the old-fashioned Cornish pump, with its costly foundation, massive walking beam, huge plunger rods and ponderous balance bob, was supplanted many years ago by the direct-connected steam pump, which soon developed into a most efficient pumping machine with duplex, triple-expansion engines and every refinement possible in modern steam-engine practice. These have in many places been superseded by the electric-driven plunger-pump, in which the high speed of the electric motor has been reduced by suitable train-gear. Latterly, quite a large number of electric pumps have been built in which the gear is entirely eliminated. The speed of the motor has been reduced, and that of the plunger raised, forming a combination known as the express pump. Pumps of this class, with capacities of 1,600 gallons per minute, raising water 1,550 feet, are now being very successfully employed in unwatering the Comstock Lode at Virginia City.

Within the last few years great improvements have been made in the electric-driven turbine-pump, which, with its entire absence of valves and reciprocating parts, threatens to dominate the field completely.

Already we have single-stage turbine pumps, raising 35,000 gallons of water per minute 150 feet; five-stage pumps raising 10,000 gallons per minute 600 feet; six-stage pumps raising against 800 feet head; and eight-stage pumps raising 400 gallons 1,400 feet; and responsible firms are ready to contract to raise water by this system to any elevation up to 2,000 feet, and guarantee a pump efficiency of from sixty to seventy-five per cent, according to conditions of service.

1 From David W. Burton's presidential address at the Spokane meeting of the American Institute of Mining Engineers, September, 1909.

Some Remarks on Electric Motor Drive.[1]

An interesting and instructive series of lectures on "The Advantages of Electricity for Power Purposes," is being delivered by the Burslem (Eng.) borough electrical engineer, Ashton Bremner, at the Wedgwood Institute. The lectures have been arranged by the education committee, and the chairman of the electricity committee, T. Willett, presided at the inaugural lecture.

Mr. Bremner dealt in a clear and lucid manner with the advantages of electric power. Electricity, he said, was supplied "on tap" from the corporation mains quite simply. The problem of laying out the electrical drive on pot-banks was undoubtedly difficult, and should not be attempted without consulting an electrical engineer—there were so many ways in which a scheme could be wrongly laid out; but once a properly qualified engineer had designed and installed an efficient scheme, a child could do the rest, as there was no need to employ specially qualified engineers to run the machinery.

He would have the manufacturers of the district to understand thoroughly that installing electricity for lighting, heating and power was unattended by any risks, and also that in the near future they must, if they wished to keep pace with the foreigner, adopt electricity in their factories. Indeed, it might be said that there were few works owners who made any claim to be considered up to date who were not using electric power in some form or other. It did not follow, because a few electric motors had been installed that all the possibilities of the new power had been realized. The electric drive, in itself, would not secure full economy of operation, but a survey of the working conditions of by far the greater number of factories in the district would reveal many unsuspected sources of loss which would be diminished by the judicious application of electric power.

The question of electrical, compared with other means of driving potters' machinery, resolved itself to a large extent into the price at which electric energy could be obtained. It might be purchased from the corporation, or it might be generated on the premises. The question was not a simple one, and to a large extent it depended upon the question of cheap power. The use of electric motors would also appreciably reduce the risks of the manufacturers under the Factory Acts. Electric motors were so constructed that accidents to attendants need not occur, and they enabled moving shafting, pulleys and belting to be reduced and in some cases entirely doing away with; and they also enabled manufacturers to make the best use of the space at their disposal, and to carry on their work on more economical lines.

The transmission losses in a factory were under any circumstances considerable, but if electric motors were used, this loss might be reduced either by employing separate motors for the large machines or by arranging the machines in groups and placing the motor near those requiring most power. If overtime had to be worked in some department the loss of power in shafting by non-electric systems was felt in its most acute form, because it was not thought worth while to disarrange the belting or ropes by disconnecting the unused length of main shafting, with the result that for the sake of a few minutes in one department, the whole of the shafting was kept running. With electric driving matters were reversed. All groups of machines other than those required were stopped, and the loss was consequently eliminated. Further, the high efficiency of electrical methods of transmission and utilization at times of light load was a great advantage, and was in great contrast to the waste of power which was a characteristic of any other kind of drive. The potting industry required machinery running at varying speeds. Direct-current motors, such as were driven from the Burslem Corporation's mains, were specially suited to the requirements of the district.

Several other lectures will be delivered, with a view to educating factory men.

1 From the London (Eng.) *Electrician*, Dec. 24, 1909.

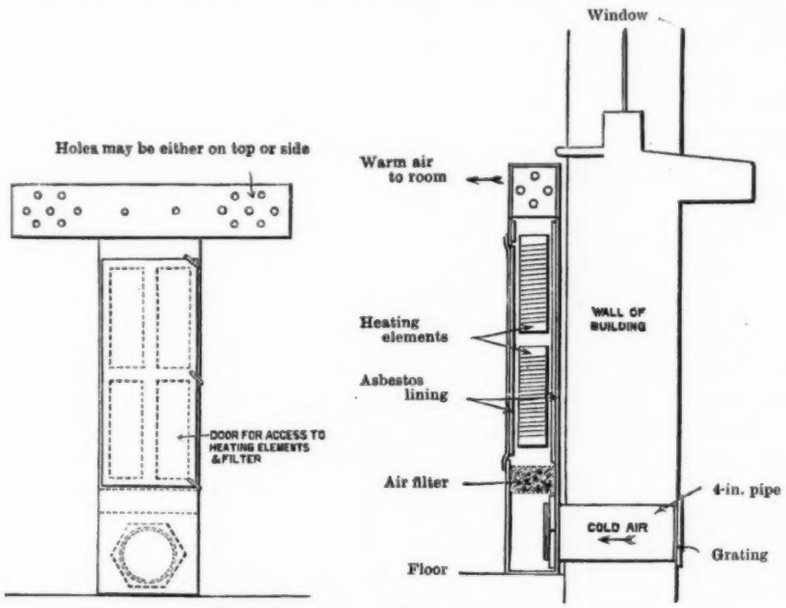
Electric Heating and Ventilation.

A simple method of heating air for the ventilation of buildings is being tried by the Westminster (London, England) Electric Supply Corporation, Ltd. As shown in the accompanying illustrations, a combination of the Tobin tube and a conveyor is employed, with or without an air filter. Any electrical heating element may be used, and the apparatus may be made of any material and any shape. It is intended as a permanent fitting, and should preferably be fixed under the windows. The air enters from the outside, and passes through a filter, then through the heating chamber, into the top, and out through holes. The front is either fitted with a door, so that the heating elements may be got at for repairs, or can be arranged so as to allow them to be taken out through the top. The heating chamber is lined with some non-conducting material, such as asbestos, to prevent the outside of the chamber getting hot.

Apparatus such as this can be made by anyone, and being inexpensive, it should appeal to householders, architects and builders. In calculating the size of heater required for any room, the company suggests that one watt per cubic foot be allowed. This would generally give more heat than required if left on, but would be useful for warming up the room quickly. When the room was sufficiently warm, one-third or two-thirds of the heat would be enough to maintain the temperature. This apparatus should be especially suitable for London houses, where there is always a difficulty in opening the windows for ventilation on account of the noise and dirt.

In the pattern to be fitted by the company, there will be three heats, as in most convectors, but this is a matter of detail. Other matters, which can be suited to individual tastes, are the methods of getting at the heating elements and filter, the shape of the top and arrangement of outlet holes, while some may wish to add a damper, others a baffle plate. The main object is to provide a system which is economical both to install and to use, and it is hoped this has been achieved.

The above description and accompanying illustrations are taken from *The Electrical Review*, of London, England, for December 24, 1909, which in turn acknowledges its indebtedness to L. H. Hordern, the manager of the Westminster company, for the particulars given.



ELECTRIC HEATING AND VENTILATING.

Railroad Switching by Electricity.

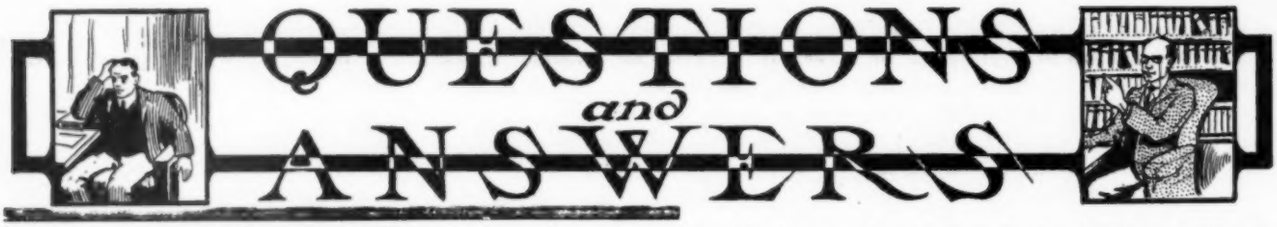
The Great Western Railway Company, of England, has adopted a motor-driven traverser to replace the switching engines formerly used on two sides of a terminal platform at its Moore Street depot in Birmingham. By this means an engine, after being disconnected from its train, can be moved bodily across to a parallel track, from which it can proceed to the other end of the train. One motor is used for each of these traversers, one on each side of the platform. Each motor is of eighteen horsepower, and runs on 110-volt, three-phase, twenty-five-cycle current, 94.5 amperes half-hour rating. The motor for each traverser lies out of sight under the movable roadway, and is operated from a switch on the station platform. It is said that the arrangement works very satisfactorily, and that further developments on this order may shortly be effected by the same company.

Electricity in Sawmills.

On account of its extremely small fire risks, says the *Electrical Engineer* of London, Eng., electricity is being employed both for power lighting in cabinet works and sawmills. The wood shops of the Manchester (Eng.) Corporation Tramcar Works are electrically driven, the motors being installed in the basement under the shops, thus efficiently protecting them from the wood dust, and leaving the shop free from all shafting. The telephone cabinet works of the Great Central Railway Company at Salford, are also electrically driven. At the present moment the Lancashire Dynamo and Motor Company has in hand four sixty-horsepower motors for the Bengal and Nagpur Railway sawmills. They will drive the line shafting direct, and are of the pipe-ventilated inclosed type, air from outside being brought in ducts through the motor, which is thus completely shut off from the dust-laden atmosphere of the shop. Electric driving is also being used for the wood shops at Sheerness Dockyard, and the same company has twelve motors in hand for the work.

A New Trolley Switch.

H. D. Murdock, of Scottsburg, Ind., superintendent of the Indianapolis and Louisville traction lines, has perfected an automatic trolley switch which bids fair to work a great change in overhead electric railway construction. The entire line of the Indianapolis & Louisville Company has been equipped with the new switches, and orders are being received from other companies. It is claimed by Mr. Murdock that the new switch will save at least two minutes at every meeting point. During the recent sleet and snow storm the switch worked admirably. As soon as the patent is secured the switch will be manufactured extensively. S.



ARGUMENTS AGAINST GAS LIGHTS.—Recently I got into a heated argument with a solicitor of the gas company about the merits of tungsten and gas lamps for house lighting. He contended that the Welsbach upright and inverted lamps are cheaper, brighter and more reliable than any kind of electric lamps and he wanted me to carry with my electrical business a line of gas lamps, mantles, etc. This I declined to do, as it would show my lack of faith in the new tungsten lamps, which I have had much success in selling and installing in the neighborhood, and because I have claimed right along that mantle lamps are hard to manage right and give lots of trouble from poor adjustment, breakage, etc. The last from my own experience. Is this not the general experience with mantle lights? The gas solicitor has started canvassing the neighborhood and I want to strengthen this argument against his lamps.—F. C. C., Detroit, Mich.

The claim that mantle lamps are hard to manage so as to give reliable service is well founded, this being the general experience of all who have given them extensive trial. The adjustment of the relative amounts of gas and air for one pressure is not apt to be proper for another pressure, resulting either in diminished light or decided blackening of the mantle when the pressure changes as it does in all gas systems more or less. A hole in a mantle frequently results in a cracked chimney or globe. Dust or dirt in the burner also produces blackening of the mantle. Frequent cleaning of the whole lamp is more imperative than with electric lamps. Breakage of mantles and glassware is surprisingly frequent and is not only annoying but generally results in a conglomerate appearance of the whole lamp due to improper renewals. The claim that gas lamps may be turned low does not apply as well to mantle lamps, particularly of the inverted type. Another defect of the latter is that they tarnish the fixture above the burner. A well-known argument against all gas lights is that they vitiate the air of an apartment by burning up the life-giving oxygen into the dangerous carbon dioxide or carbonic acid gas; if not burning properly there are even more noxious products of combustion given off. In summer gas lights heat a room to an uncomfortable degree. At all times their heated and sulphur-containing products tarnish the ceilings, walls, pictures, draperies, and other furnishings and contents of a room, necessitating frequent redecoration and cleaning thereof.

ARCING AT TROLLEY INTERSECTIONS.—At the trolley intersection on one corner I have noticed much increase in vicious greenish sparking at the trolley wheels since the big cars were put on. It is especially noticeable during the rush hours. Both these facts lead me to think it is caused by the increased power required by the heavy cars, but the strange thing to me is that some of the heaviest loaded cars do not spark at all. Why is this?—M. L., Chicago.

At the instant that the trolley wheel passes the intersecting point the circuit to the car is momentarily interrupted. If the current passing to the car at this instant is heavy, partiularly if the motors are in active service, violent sparking occurs between the wheel and overhead conductor, because of the self-inductive action of the current in trying to maintain itself by vaporizing particles of the copper parts between which the circuit was broken. This results in the greenish flash characteristic of burning copper vapor. If no current passes to the motors at the instant that the trolley wheel crosses the intersecting point, little sparking results because then only the comparatively small current taken by the lights or electric heaters is involved and neither the lighting nor the heating circuits contain much self-induction. The sparking is not only destructive to the trolley wheels and overhead work, but the sudden interruption and re-establishment of full power puts a severe strain on the motors and driving gear. Therefore all electric railways have standing rules that motormen must cut off the current from the motors while crossing an intersecting point. Unfortunately some motormen do not observe these rules.

ALUMINUM ELECTROLYTIC RECTIFIER AS AN INTERRUPTER.—Can the principle of an aluminum electrolytic rectifier be used for an electrolytic interrupter on sixty-cycle, alternating currents? If so, how?—C. O. S., Los Angeles, California.

The aluminum cell electrolytic rectifier can be used as an interrupter for an induction coil supplied with alternating current, provided it is desired to impress only direct current on the primary of the coil. Such a combination rectifier and interrupter is composed of a plate of aluminum and one of some other metal, preferably lead, immersed in an electrolyte of an alkaline phosphate, such as a solution of ammonium phosphate. The current passes from the lead to the aluminum, but not appreciably in the opposite direction because of a counter electromotive force set up on the surface of the aluminum plate when it becomes the anode. This counter electromotive force varies from about forty to 400 volts, depending on the nature and strength of the electrolyte. Above a critical voltage reversed current also passes.

STORAGE BATTERY WITH ZINC PLATES.—I have seen a new storage battery on trial which gives two and one-half volts and is claimed to stand much more severe service than the ordinary storage battery. It is all sealed up in a zinc can to which one terminal is soldered. The inventor does not say what it contains. Is it likely to revolutionize all battery work, as he claims?—J. V. R., Joplin, Mo.

This battery in all likelihood is a modification of the type of storage battery known some fifteen or twenty years ago under various names, notably as the Waddell-Entz cell, in which lead peroxide is the positive material and zinc the negative in an electrolyte of dilute sulphuric acid or zinc sulphate. This type of cell gives close to twenty-five volts at the beginning of discharge. During the discharge some of the zinc from the negative plates is dissolved, during charge it is supposed to be redeposited again, but never is completely nor in an adherent form. Consequently both the efficiency and life of the battery are low, very much lower, in fact, than in the lead peroxide-lead-sulphuric acid type of accumulator almost universally used. The zinc type of accumulator has been exploited unscrupulously from time to time by certain individuals who knew its ultimate shortcomings.

BOOK REVIEWS.

"The Calculus and its Applications." By Robert Gordon Blaine. D. Van Nostrand and Company, New York, N. Y. Cloth, 321 pages (4¾ by 7½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.50.

This book is compiled principally from notes and observations made by the author while teaching the subject to students whose mathematical knowledge was very limited. The difficulties which beset the beginner are fully explained, and the principles of the differential and integral calculus, and differential equations, are clearly set forth in the simplest language. A large number of the problems have been fully worked out for the sake of many who wish to obtain a working knowledge of the subject without the aid of a teacher. Applications of the calculus to problems in engineering and physics form a feature of the work, which concludes with an up-to-date chapter on harmonic analysis of special interest to electrical engineers and students of electrotechnics.

"A Handbook of Wireless Telegraphy and Telephony." By William Maver, Jr. Maver Publishing Company, New York, N. Y. Cloth, 354 pages (5¾ by 9 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $3.00.

This fourth edition is a further development and revision of data which originally formed the appendix to the author's "American Telegraphy and Encyclopedia of the Telegraph" until the rapid progress of the wireless branch of the industry made it apparent that a separate book was necessary. The general lines of treating wireless telegraphy and telephony in this book are along those of "American Telegraphy." Each subject has been treated in language as free from mathematical formulas as possible and the whole work is written in a manner designed to be clear to the general reader. In the present edition, while theory is not neglected, the author has paid particular attention to the practical features of the subject, this edition containing practical descriptions of the latest improvements in wireless telegraphy and telephony. Each of these descriptions is accompanied by comprehensive illustrations and diagrams. The book is divided into two parts, treating wireless telegraphy and telephony separately. An amateur's department has also been added to this edition which will prove interesting to those desiring to construct and use wireless systems.

"The Dynamo." Fifth edition; two volumes. By C. C. Hawkins and F. Wallis. The Macmillan Company, New York, N. Y. Cloth, 1134 pages (5¾ by 8¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $5.50.

Regarding the theory of the dynamo there is very little change noted in this fifth edition from its predecessors. However, in practical design and the art of manufacture many changes have been brought about by the necessity for the utmost economy in materials and labor to meet the stress of keen industrial competition. Whether for direct-current dynamos or alternators, the drum armature with toothed core has so far displaced all other types that it has become superfluous to consider at length any other kind. In consequence the ring and disk armatures after a preliminary description, are entirely ignored. The drum is only considered in its modern toothed form. On the direct-current side the carbon collecting brush still holds the field and therefore the treatment of commutation and of the sparking limitations of the dynamo has been greatly expanded. The theory of auxiliary commutating poles is considered more fully than in previous editions. The mechanical construction of the commutator, both of the V type and shrink-ring type, has also been treated in greater detail by the author. Among other additions on the alternating-current side may be mentioned the full analysis of the armature reaction of the alternator, and also a more detailed and thorough consideration of the running of alternators in parallel. Other changes and additions more or less important have been made, new illustrations embodied in the text and as a whole these books should prove even more valuable to students and engineers than the earlier editions.

"Der Betrieb Elektrischer Licht—und Kraftanlagen." (The Operation of Electric Light and Power Plants.) By H. Pohl. Dr. Max Jänecke, Hanover, Germany. Boards, 131 pages (4¾ by 6¾ inches), 89 illustrations. Price (in Germany) 2.50 marks.

This little German book is a practical handbook for the operatives in electric generating stations. It covers a great range of subjects in a compact and pithy manner. The first part of the book is devoted to the operation and care of the mechanical equipment of the plant, including the boilers, feed-water pumps and heaters, steam or gas engines, steam or hydraulic turbines, condensers and auxiliaries. Each type of apparatus is briefly described, its principles stated and its care clearly explained. Special attention is given to firing, lubrication, and indicating engines. In the second part of the book the electrical equipment is similarly considered. Among the apparatus treated of are dynamos, accumulators, transformers, measuring instruments, switches, cables, incandescent and arc lamps, motors. Particular mention is given to dynamo tending and dynamo troubles, switching, working on live lines, lamp trimming and motor troubles. What to do in cases of fire and other emergencies is stated briefly. An outline of a system for keeping the plant records is near the end of the book. It is a regret that this valuable little book has not yet been translated into English.

"Lecons d' Electrotechnique Generale." Vol. II. (General Lesson on Electrotechnics.) By P. Janet, Gauthier-Villars, Paris, France. Paper, 320 pages (6½ by 10 inches) with many diagrams. Price (in France) 11 francs.

Beginning with the most simple of the elementary equations the author has very ably carried out the derivation of many formulas relating to alternating-current phenomena. Both geometrical and circle diagrams have been freely used to aid the student in grasping the new ideas and following the author's chain of reasoning. The subject of instantaneous values of functions and of vector addition of harmonics of different phase relations is quite thoroughly dealt with.

Each phenomena is in general, after a statement of the law in its most simple terms, worked out for several circuits having resistance, capacity and inductance in some combination. In further development each class of apparatus is taken separately, beginning with the single-phase alternator, then taking up a coil with an iron core, and finally transformers. The book as a whole can only be compared to one other, Steinmetz's "Theory of Alternating Currents," and is simply a

mathematical development of electrical theory.

"Motor Control." By Andrew Olsson. D. Van Nostrand Company, New York, N. Y. Paper, 23 pages (5¼ by 7¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $0.50.

This book is No. 1 of the "United States Electrical Series," and comprises a very full and lucid account of the Ward-Leonard system as used in connection with turret turning and gun elevating practice in the United States Navy. The system is explained in detail with the aid of numerous diagrams, and full operating instructions are also given.

"The Slide Rule." By J. J. Clark. Technical Supply Company, Scranton, Pa., and New York, N. Y. Cloth, 62 pages (4¾ by 6¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $0.60.

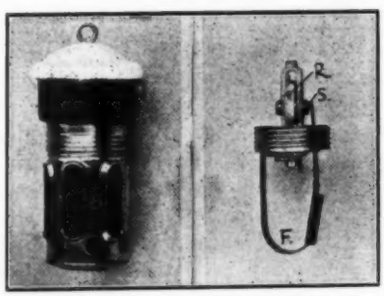
This little book should prove of great value to the owner of a slide rule who does not know how to use it properly. Anyone who has an ordinary knowledge of arithmetical processes should be able easily to use his rule, after spending a little time in practice according to the instructions in the book. The treatment of the slide rule in this publication is extremely lucid, and the explanations possess the merit of fixing the attention in such a way as to impress themselves for all time on the mind of the reader. Everything is brought down to the irreducible minimum compatible with clearness and accuracy, and anyone reading the book for the first time and hitherto unacquainted with the slide rule will wonder however he has managed to get along with his calculations without the use of this invaluable, practical and withal simple instrument, which should be the inseparable companion of every engineer whatever branch of the profession in which he may be engaged.

"Lecture-Notes on the Theory of Electrical Measurements." By William A. Anthony. Revised by Albert Ball. John Wiley & Sons, New York, N. Y., cloth, 122 pages (4¾x7¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.00.

This work was originally prepared for the third-year classes of the Cooper Union night school of science, and the notes embodied in it furnish the student with the topics treated in the lectures and treat of such facts, data and courses of reasoning as are not readily mastered by the student in the course of the lectures. In short this work should aid the student in those matters which he is likely to find most difficult or which he may fail at the moment to grasp. The purpose of this course of lectures is to teach the fundamental principles of all electrical measurements, rather than to describe in detail methods employed in particular cases. To this end the definition and relations of electrical quantities have been discussed at considerable length, and the derivation of the electrical units has been fully treated. To this revised edition numerous problems have been added which have been selected with great care in order that their proper solution may indicate the application of the principles discussed in the text. A few of the principles have been more fully elaborated and paragraphs upon capacity and its measurements have been incorporated.

Automatic Fire Alarm.

The Siemens & Halske Company has just placed on the market a new fire detector described in a recent issue of the Belgian paper *Electro*. The



AUTOMATIC FIRE ALARM.

device employs the unequal expansion of two metals soldered together to make a spring of appropriate form and dimensions. As the illustrations show, the spring F presses ordinarily on the contact S which can be regulated by the wheel R, so that current will pass. If the temperature is increased the spring stretches and the contact is broken. By a suitable adjustment of the contact pressure it can be arranged so that the breaking of the contact is made and consequently the warning is given at any desired temperature. The regulator is provided with a scale of temperatures. The device is composed of three principal parts: first a porcelain base, which holds the spring, the contact and the regulating wheel; second a perforated cloth protecting cap, which screws on the porcelain base and which protects the spring, yet enables the air to pass freely; third, a porcelain body similar to an incandescent lamp socket.

This arrangement considerably facilitates the installation of the device and avoids injury through mishandling. Moreover, the arrangement permits the part carrying the spring to be changed without taking out the lead wires. The alarm is set so as to be suspended by a spiral spring or a steel spring so as to give protection from shocks which might produce an interruption of contact and consequently cause a false alarm to be made.

Standardization of Rubber Material for Insulated Conductors.

In order to insure the reliability of insulated conductors and to be certain that they actually meet the requirements made of them, the German manufacturers of insulated conductors have united and entered into an agreement with the Royal Testing Bureau, under which it will be possible for the consumers to have the insulating material of conductors provided with the mark of the manufacturers, tested as to its chemical properties, partly at the cost of the association. An extract from this agreement setting forth its principal conditions, as cost, extent and nature of the test, is published in the *Elektrotechnische Zeitschrift* of December 16, 1909. The composition of the rubber material for standard conductors is to be as follows: Thirty-three and three-tenths per cent of India rubber containing not more than four per cent of resin; sixty-six and six-tenths per cent of admixtures, including sulphur. It is expected that the standardization of the insulating material will improve the position of German products for the electrical and other industries in the world's markets.

Electrical Supplies.

An American consul states in a recent report that an electrical company in the city in which he is located is desirous of getting in touch with manufactures in this country exporting electrical supplies such as insulated wires, electric meters, electric burners, etc. If prices and goods prove to be satisfactory, the consul thinks this firm will be a good customer. Those interested should address the Bureau of Manufacturers, Department of Commerce and Labor, Washington, D. C., and refer to File No. 4353.

FINANCIAL REPORTS OF ELECTRIC COMPANIES.

UNITED RAILROADS OF SAN FRANCISCO.

The report of the United Railroads of San Francisco for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$619,313	$574,521
Expenses	352,570	316,333
November net	$266,743	$258,188
Eleven months gross	6,810,119	6,262,900
Expenses	3,862,446	3,899,680
Eleven months net	$2,947,673	$2,363,220

OREGON ELECTRIC RAILWAY.

The report of the Oregon Electric Railway Company, for the month of November, 1909, compares as follows:

	1909	1908
November gross	$34,785	$21,984
Expenses and taxes	22,824	16,051
November net	$11,961	$5,933

PHILADELPHIA COMPANY.

The report of the Philadelphia Company for the month of November compares as follows:

	1909	1908
November gross	$1,701,493	$1,453,977
Expenses	962,855	804,374
November net	$738,638	$649,603
Other income	194,752	180,359
Total income	$933,390	$829,962
Charges	592,622	261,400
November Surplus	$340,768	$568,562

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of November and eleven months ended November 30, compares as follows:

	1909	1908
November gross	$123,651	$111,794
Expenses	69,771	58,996
November net	$53,880	$52,798
Eleven months gross	1,284,806	1,203,884
Expenses	748,696	672,396
Eleven months net	$536,110	$531,488

AMERICAN CITIES RAILWAY AND LIGHT COMPANY.

The American Cities Railway and Light Company reports combined earnings of the operating companies for the month of November and eleven months ended November 30, 1909, compared as follows:

	1909	1908
November gross	$519,203	$472,332
Expenses and taxes	291,995	281,626
November net	$227,208	$190,706
Interest and sinking fund	106,747	105,214
Surplus	$120,461	$85,492
Am. Cities prop. surplus on basis stock ownership	*107,311	76,115
Eleven months gross	5,270,012	4,940,627
Expenses and taxes	3,053,242	2,982,442
Eleven months net	$2,216,770	$1,958,185
Interest and sinking fund	1,170,315	1,147,912
Surplus	$1,046,455	$810,273
Am. Cities prop. surplus on basis stock ownership	†925,328	711,422

*Equivalent to 8.11 per cent on common stock of American Cities Railway and Light after allowing for preferred dividend as against 4.64 per cent last year.

†Equivalent to 5.53 per cent on common stock of American Cities Railway and Light after allowing for preferred dividend as against 3.36 per cent last year.

HUDSON TUNNEL TRAFFIC GROWS.

The Hudson Tunnel System carried 4,053,586 passengers in December, which is an increase over the number carried in August last, the first month of the operation of the present system, of fifty-two per cent, or an average increase of over ten per cent per month. This showing is regarded as remarkable in view of the fact that two of the company's most important stations, namely at Thirty-third Street and Broadway in New York city, and at Newark and Railroad Avenues in Jersey City, are not yet finished. Their construction is well under way and they will be completed in the fall of this year, an event that will without doubt greatly increase the traffic.

On the basis of the December business of the tunnels and with about eighty per cent of the space in the Hudson Terminal Buildings now rented, the company will earn its full fixed charges for the current year. The growth of the traffic through the tunnels since the first ones were thrown open for business in December, 1908, makes a remarkable showing. In that month only the line between Hoboken and Twenty-third Street and Sixth Avenue was in operation and the number of passengers carried was 1,407,808. Last month, while the present system in operation, the traffic was 4,053,586—an increase over the December of the previous year of over 190 per cent. Should the traffic continue to increase at the rate of ten per cent per month as it has during the past five months a surplus on the common stock will soon be earned.

With a view of informing the public more widely than heretofore of its facilities the company has begun an extensive campaign in the newspapers, which includes the publication of a map of the system and of facts showing the time that can be saved by using the tunnels, as well as the comforts and conveniences for passengers.

New Public Service Corporation Stock.

The Public Service Corporation of New Jersey has filed with the Secretary of State at Trenton, N. J., a certificate showing that it has just issued and sold additional shares of capital stock to the extent of $3,818,800.

Boston Elevated.

Very little increase was reported in the gross income of the Boston Elevated Railway Company in the annual report made to a meeting of the stockholders. Dividends show a slight increase, and nearly eight million more passengers were carried, an increase of about 2.88 per cent, the total number being 281,008,471. Major General William A. Bancroft called the meeting to order and presided. The present board of directors, consisting of Fredcrick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, Frank E. Peabody, James M. Prendergast, N. W. Rice, Quincy A. Shaw, William S. Spaulding and Robert Winsor, were unanimously re-elected by a vote of 74.186 shares.

Besides its ordinary taxes the company's contribution to the public during the last fiscal year amounted to at least $430,573.27, which is about 12.4 per cent of the gross revenue of the company for the year. Going into the matter of capitalization the report says:

"The present capitalization of the two companies represents an actual payment in cash of $3,978,017.26 above the par value of the outstanding stock. The amount of this cash premium has been invested in the properties now owned by the companies. So there is not only no capital inflation of these properties, but much more has been paid in than is represented by the par value of the stocks. The dividends paid on the stocks and interest paid on the bonds of the two companies make an average return to the capital invested of something less than 5.13 per cent per annum.

"From the summary of stockholders of record of October 1, 1909, it appears that the total number is 3,972, holding 134,501 shares of stock. Of these 3,505, holding 116,818 shares, live in Massachusetts. In other words, eighty-seven per cent is held in Massachusetts.

"The total length of surface tracks controlled by the company is now 460,-039 miles. This, with the elevated mileage of 24.087 miles, makes a total mileage of 484.126.

The business of the company for the year is summarized as follows:

Gross earnings	$14,493,853.13
Operating expenses	9,488,483.83
	$5,005,369.30
Fixed charges and depreciation	4,163,951.98
	$841,417.32
Dividends	802,503.00
Surplus	$38,914.32

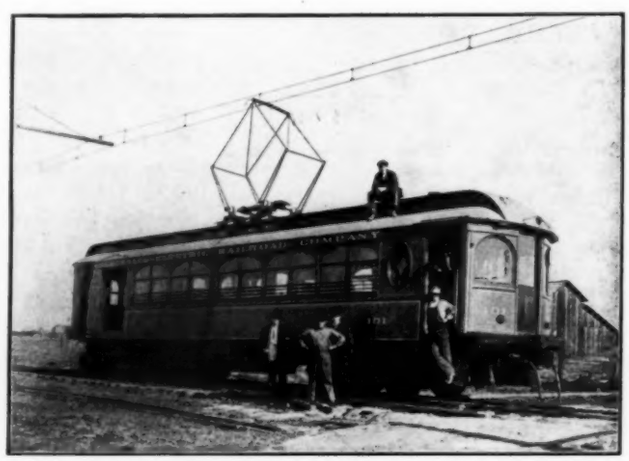
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Visalia Fifteen-Cycle, Single-Phase Railway.

The first, and at the same time the only, fifteen-cycle, single-phase, alternating-current railway in the United States is the Visalia Electric Railroad, running from Visalia to Lemon Grove, Cal. After two years of successful operation, this pioneer fifteen-cycle development has fully justified the confidence and courage of its builders in selecting, untried, a system of electrification without the restrictions for heavy main line service shown by the other systems investigated. Although the present length of electrical operation is only twenty-two miles, the location of the Visalia road is such that it will undoubtedly become an important link in the large electric railway system which seems destined to cover that section of the San Joaquin Valley at a date not far distant.

WESTINGHOUSE ELECTRIC LOCOMOTIVE ON VISALIA ELECTRIC RAILWAY.



SINGLE-PHASE INTERURBAN CAR ON VISALIA ELECTRIC RAIWAY.

For a distance of ten miles, between Visalia and Exeter, the electric railway traverses the main track of the Southern Pacific Railroad, which has been electrified over this section by the addition of rail bonds, and the 3,300-volt trolley. Twelve miles farther, from Exeter to Lemon Cove, a new road bed has been constructed, making the total length of the Visalia-Lemon Cove electrified route twenty-two miles. The road is single tracked throughout with the exception of the switching and freight yards at Visalia, Exeter and Lemon Cove. The trolley construction is of the single catenary type, suspended from brackets on poles spaced 120 feet apart.

Ground was broken for the Exeter and Lemon Cove extension in March, 1905, and the road was operated by steam locomotives in December, 1905. In March, 1908, the steam service was discontinued, and since that the road has been operated by electricity.

From Visalia to Exeter the country is practically level. Between Exeter and Lemon Cove the land is of a rolling nature, but the maximum gradient on the road has been kept down to 0.9 per cent, and the curves are of long radius. The worst conditions are met on a combined ten degree curve on a 0.9 per cent grade.

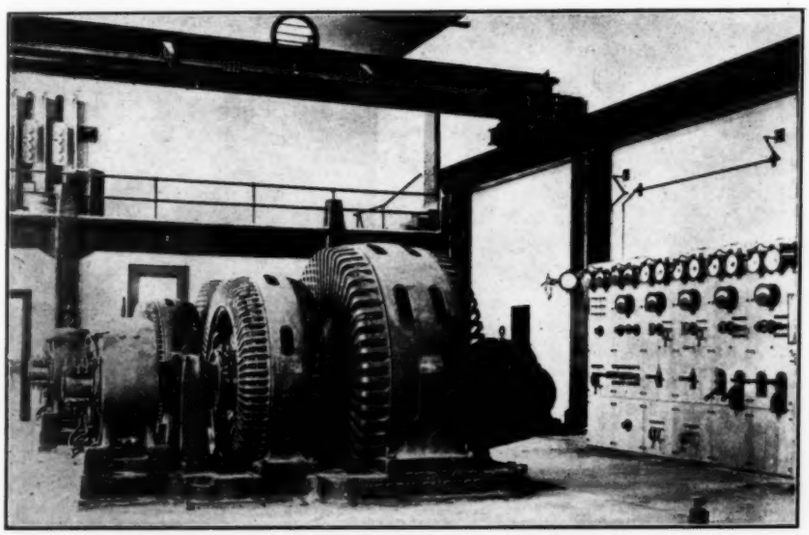
For this electrification, three-phase, sixty-cycle power is purchased at 35,000 volts, from the Mount Whitney Power Company, which operates a hydroelectric generating plant on the Keweah River. At the Exeter substation, located nearly at the center of the present railway line, the sixty-cycle power is stepped down to 2,200 volts, and then converted to fifteen-cycle, 11,000-volt, single-phase current by a Westinghouse synchronous motor-generator set. From the main frequency-changing substation at Exeter, the fifteen-cycle, 11,000-volt feeder lines, made up of a pair of No. 4 bare copper conductors, transmit eight miles in each direction to the substations on the Lemon Cove and Visalia divisions. Transformers in these stations reduce the fifteen-cycle, 11,000-volt, single-phase supply to the trolley pressure, 3,300 volts.

The frequency-changer substation contains six 150-kilowatt oil-insulated, water-cooled, 35,000 to 2,200 volts, sixty-cycle Westinghouse transformers, and two two-bearing motor-generator sets, each composed of a 540-horsepower Westinghouse synchronous motor wound for 2,200 volts, sixty-cycles, with induction motor for starting; direct connected to a 375-kilowatt, rotating field, single-phase Westinghouse alternator, delivering 11,000 volts, sixty-cycle current. The sixty-cycle in-coming transmission line is protected by low equivalent lightning arresters, complete with oil-insulated choke coils and disconnecting switches. Three fifteen-kilowatt, 2,200 to 200-volts, sixty-cycle transformers are supplied for lighting service and for operating the motor-generator exciter set. On the extended shafts of each motor-generator set are mounted 125-volt direct-current generators which furnish excitation current, in addition to a similar direct-current exciter driven by a three-phase, sixty-cycle induction motor supplied from the in-coming transmission lines. The out-going 11,000-volt, fifteen-cycle feeder circuits are protected against lightning discharges by complete arrester apparatus, and are controlled by oil switches. The Exeter

substation also feeds the trolley wire through two 300-kilowatt, oil insulated, self-cooling, fifteen-cycle, single-phase transformers, reducing from 11,000 to 3,300 volts.

The two fifteen-cycle transforming substations, each located about eight miles from Exeter in the direction of Lemon Cove and Visalia, respectively, contain a Westinghouse 300-kilowatt, oil insulated, water-cooled, fifteen-cycle, single-phase transformer, reducing from 11,000-volts to the trolley pressure. Lightning protective apparatus, choke coils, and high tension circuit-breakers are included in the 11,000-volt apparatus, while the 3,300-volt trolley feeders are controlled by oil circuit-breakers.

The fifteen-cycle, 3,300-volt, single-phase trolley construction is of the single catenary bracket type, comprising a seven-sixteenth-inch steel messenger suspended from poles 120 feet apart, and supporting No. 000 trolley wire. The redwood poles, thirty-six feet long, are set six feet in concrete.



INTERIOR OF EXETER FREQUENCY-CHANGING SUBSTATION.

The rolling stock comprises: A forty-seven-ton Baldwin-Westinghouse electric locomotive, equipped with four 125-horsepower Westinghouse series, compensated, single-phase motors driving thirty-six-inch wheels through a gear reduction of seventeen to sixty-six. Four forty-ton passenger cars, each equipped with four seventy-five-horsepower motors. Two twenty-eight-ton trailer cars of construction similar to the above motor cars.

Cars and locomotives are all supplied with unit switch control, and automatic air brake equipment. The trailer cars as well as the motor cars are fitted with brake valves and master controller so that three-car trains can be operated from a trailer car at the head of the train if desired.

The motor cars and locomotives are supplied with power through panatgraph trolleys, and carry auto-transformers arranged with tape for reducing the trolley pressure to voltages suitable for supplying the motors, car lighting, and air compressors. The motor cars have oil insulated, self-cooled auto-transformers, while that on the locomotive is air cooled from the motor-driven blower equipment furnished for the forced ventilation of the motors.

The forty-five ton electric locomotive is of the double swivel truck class, provided with car type of cab, and has the following general overall dimensions: Length over bumpers, 29 feet; extreme width, 9 feet, 6 inches; height, rail to top of cab, 11 feet, 7 inches; rigid wheel base, 7 feet, 4 inches.

With its four 125-horsepower motors connected to thirty-six inch wheels through a gear reduction of sixty-six to seventeen, this locomotive is capable of developing a continuous draw-bar pull of 4,500 pounds at twenty miles per hour on level track. The full-load draw-bar pull is 9,000 pounds at seventeen miles per hour on the level. The maximum starting draw-bar pull is 17,000 pounds.

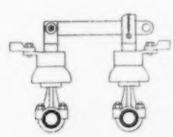
The capacity of each substation was designed to take care of the electric locomotive fully loaded, or one train of two motor cars and one trailer. In general service, only single motor cars are operated, without trailers, but when crowds are to be handled or the traffic conditions warrant, three-car trains are run. As an operating test, a six-car train has been successfully operated over the entire system.

A recent incident provides evidence of the ample tractive power of the locomotive. While doing some switching around the yard at Exeter, in order to get hold of a certain car, it was necessary for the electric locomotive to move a string of forty standard refrigerator cars standing in the way. Twenty-eight of these were loaded, making the total weight of the train 1,044 tons, which was handled and switched around the yards by the electric locomotive without special effort.

Pipe-Mounting Disconnecting Switches.

In constructing high tension distributing systems it is frequently desirable or necessary to employ disconnecting switches located in the high tension conductors. The general practice is to mount the switches on insulators, which are in turn mounted on marble bases provided with the necessary holes to permit fastening of the entire structure to a wall or panel board.

In many cases, however, a much simpler and neater construction can be secured if pipe work supports are used wherever possible, and to meet these conditions the disconnecting switch illustrated herewith is being marketed by the Central Electric Company, of Chicago, Ill.



PIPE-MOUNTING DISCONNECTING SWITCH.

To insure a sufficiently high insulation factor the switch contacts are secured to high grade, tested petticoated insulators cemented to iron pins. The various contact areas are in accordance with recognized engineering practice and the several parts so proportioned as to give maximum mechanical strength.

In common with standard practice the switches are operated by means of a treated wooden rod having at its upper end a projection designed to fit a hole in the switch lever. A complete line for all ampere capacities in voltages from 1,100 to 110,000 have been developed for pipe frame mounting.

Universal Pipe-Bending Machine.

The universal bending machine shown in the accompanying illustration is particularly adapted for use as a conduit bender and is capable of making any shape or style bend which may be desired, taking in anything from a one-eighth inch tube up to the largest size which one may have occasion to bend.

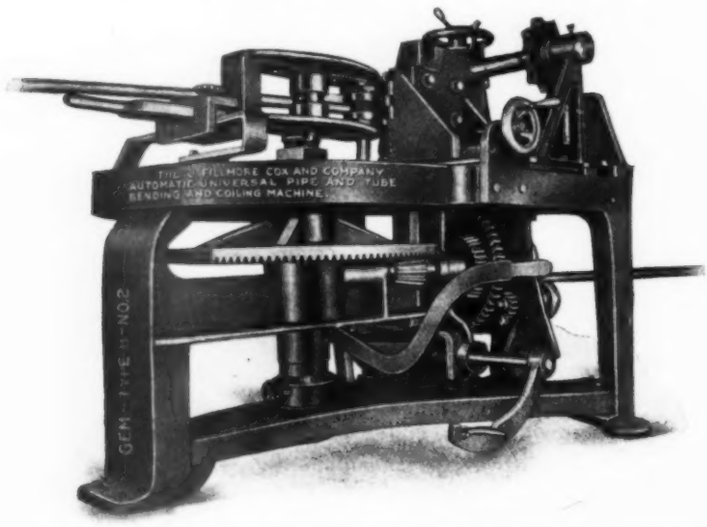


FIG. 1.—SIDE VIEW OF AUTOMATIC, UNIVERSAL BENDING MACHINE.

Some idea of the constructive details and methods of use can be gained from Fig. 2. By means of adjustments in various planes the pipe or conduit can be bent into any required size or shape, while with proper attachments the machine produces bends automatically. The machine in this view is producing radical bends. The dotted lines indicate the curvature of the tube if the radial bending arm as shown were brought forward. The machine is equipped with a traveling endless chain mechanism placed so as to travel half above and half below the table, and beneath the pipe or tube that is being operated upon.

This form of construction has been adopted for various purposes, one of which is the placing of the friction clutch of the hand wheel so as to be more easily reached by the operator, as it is placed at the forward corner of the bed-plate.

This machine is being placed on the market by J. Fillmore Cox & Company, Bayonne, N. J.

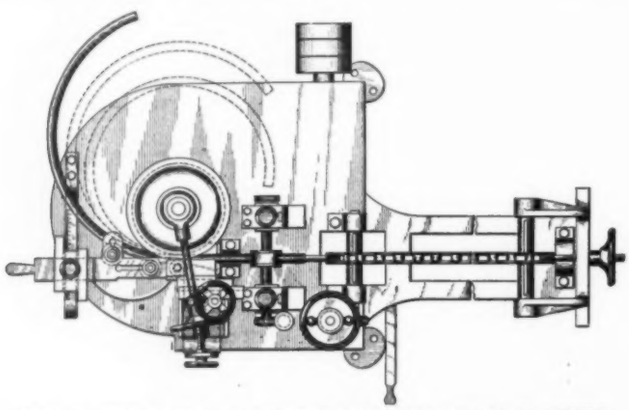


FIG. 2.—TOP VIEW OF MACHINE SHOWING RADIAL BENDS.

Tungsten Lighting for Grand Forks, N. D.

The city of Grand Forks, N. D., has decided to fall into line in the matter of efficient public lighting. It is reported that the entire business section is to be lighted by tungsten lamps, each block to have eight ornamental five-light posts. Commercial lighting is also to be extended.

The Elmo Electrically-Driven Washing Machine.

Nowhere in the field of power, as applied to the modern household, does electricity promise to become more popular than in the operation of the washing machine. This method of washing requires practically no attention, does not wear the clothes out and accomplishes the task of cleaning quickly and thoroughly.

The Elmo washing machine, which is shown here, has many points that make it exceedingly desirable, both mechanically, electrically, and still better, desirable from the woman's standpoint.

Mechanically there is little to be desired. The machine is constructed on the back gear principle, which insures a smooth, easy motion, with but little strain on the motor. Its few parts mean longer wear and less liability to get out of order. All the gears are inclosed, eliminating change for mangled fingers or torn clothes. The wringer, which is bolted solidly to this machine, is an improved type, with inclosed gears and coiled springs. The rubber is of the best quality, and, in fact, this wringer has no superior in the market today. This wringer is so attached to the gearing on the tub that it is readily reversible; the reverse motion is accomplished by shifting a lever from one notch to another. This reversible feature is very essential in a power-driven machine. Moreover, in opening the machine it is not necessary

THE ELMO ELECTRICALLY-DRIVEN WASHING MACHINE.

to remove any part of the machinery. In raising the lid the washer automatically goes out of gear.

The motor is a one-eighth horsepower improved type, inclosed so as to prevent damage from water and is bolted to a board underneath the bottom of the tub. This motor is connected to the washing machanism by a flexible, rounded leather belt especially adapted for machines of this character, as it hugs the pulley closely without undue strain on the bearings.

This washing machine is manufactured and has been placed on the market by Thompson Brothers Company, of Grinnell, Iowa.

The Hutchison Electrical Tachometer.

The Hutchison electrical tachometer is a new instrument for indicating precisely the rate of rotation of any machine at one or more points remote therefrom. Th tachometers with which American engineers are most familiar use either the principle of centrifugal force or electricity in their operation. In both forms the indicator of speed bears a limited place relation to the rotating shaft, the rate of which is to be shown. That is, the rotor is mounted in the indicating portion and is direct connected, belted or driven through some flexible coupling from the shaft, and must necessarily be located adjacent to the shaft, or at a short distance, limited by the mechanical difficulties of positively transmitting motion therefrom. An illustration of successful short transmission of rotation is the automobile speed meter.

For greater distances and for precise work recourse must, however be had to other than mechanical means. To cover this broad field, beyond the reach of ordinary speed indicators, is the purpose of the Hutchison electrical long distance tachometer, illustrated herewith, being marketed by the Industrial Instrument Company, Foxboro, Mass.

Essentially the Hutchison tachometer may be considered as two parts: 1 An alternating-current generator, or magneto, of the revolving field inductor type, driven by the shaft, the speed of which is to be measured. 2 A voltmeter, wired up to the generator, and located at any remote point where indications of speed are desired. The voltage of the generator is proportional to its speed, so that the voltmeter can be calibrated to read direct in revolutions per minute.

In practice a plurality of voltmeters or indicators, placed at widely separated points, may be operated from the same generator, so that the tachometer will indicate speeds at as many points as desired, as far away as desired, within reasonable limits. A number of operators, therefore, at widely separated points can have precise indications of speed always before them, so that intelligent, concerted action may result. The closer bond between navigator and engine room on steamships is an illustration of the service rendered by this instrument. It makes remote control of speeds precise, sure and easy.

The technical press in past years has mentioned somewhat similar long distance tachometers, operated from direct-current generators. These, however, have not come into general successful use in America, owing in some cases, it is said, to mechanical and electrical troubles. These troubles, it is claimed, have been eliminated in the fundamentally different alternating-current type.

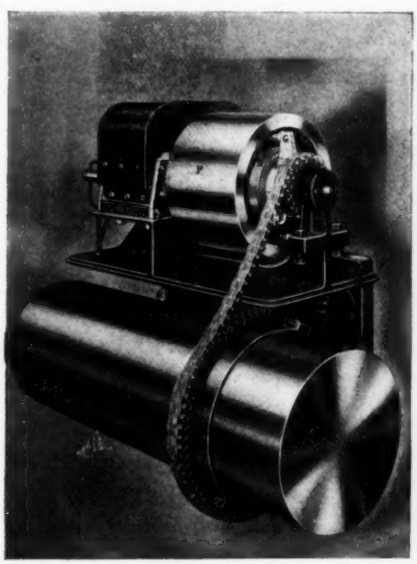


FIG. 1.—VIEW OF GENERATOR FOR HUTCHISON MARINE TACHOMETER.

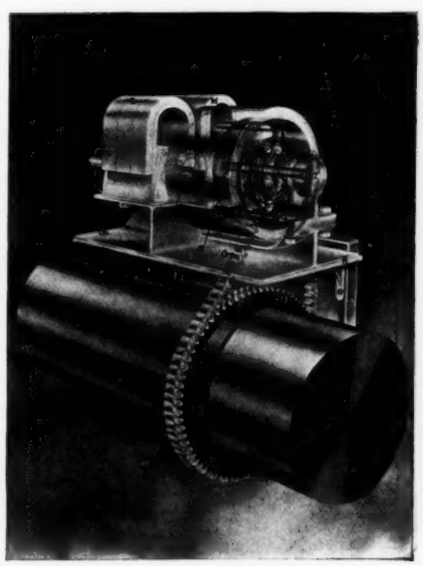


FIG. 2.—OUTLINE VIEW SHOWING INTERIOR CONSTRUCTION.

The alternating-current generator eliminates brushes and commutators and, therefore, the variable pressure and resistance between them. The makers state that every joint in the circuit from the armature to indicators is soldered. The generator can be very small and compact, and the indicators built to operate on a minute current. The conductors are, therefore, small and introduce little drop and the load on the generator (even with a plurality of indicators) is comparatively small.

The evident value of such a tachometer in marine service led the inventor to develop first the marine type, which will here be described. It was first placed on a ship about eighteen months ago, but two years have been spent perfecting details and in preparing for extensive manufacture.

The application to ship service necessitated several modifications in design, the principal ones being twin generators, so as to show direction of rotation as well as rate, inertia compensators for angular variation of speed of driving shaft and special form of indicators. Otherwise the description of the marine type will convey a good idea of the principle and construction of this new instrument.

Referring to Figs. 1 and 2, which are similarly lettered, *P* represents the ship shaft. Clamped around it is the split sprocket *A*. Rotation is imparted to the driving sprocket *B* by the Morse silent chain *C*. Sprocket *B* is not keyed to the generator shaft *D*, but is simply rotatively mounted thereon. Two oppositely coiled flat spiral springs *E*-*E'* transmit the rotation of *B* to the flywheel *F*, which is keyed onto shaft *D*, one end of ach spring being attached to the sprocket *B*, and the other end to the flywheel *F*. Any irregularity, therefore, of rotation in *B*, caused by variations in angular velocity of shaft *P*, is smoothed out by *E*-*E'*, so that the rotation imparted to *F* and *D* is a constant resultant speed. The springs are protected against strain or breakage from sudden reversal

of *P* by radial arm *G*, engaging pin *H*, attached to flywheel.

On the inside face of flywheel, Fig. 2, at the end opposite from that occupied by *E-E'*, are cut gear teeth, so arranged as to engage pinions *J* and *K*, which actuate magnetos. Pinion *K* is keyed to the indicator shaft of its magneto *M*.

Pinion *J* is not keyed to its shaft, but so mounted that when direction of rotation of main shaft is "ahead" the inductor of magneto *L* is in the exact rotative relation to its armature and pole shoes as that of magneto *M*. The current from *L* is therefore in phase with that from *M*, but when *P* is reversed in rotation, pinion *J* rotates idly on the shaft of magneto L, until it has traveled 90°, at which point it begins to drive the magneto. The result is that the inductor of *L* assumes an exactly opposite relation to its armature and pole pieces as obtains at the same instant in *M;* hence the current from *L* is 180° electrically out of phase with *M*.

Two wires run from *L* and two from *M* to each indicator. When running "ahead" the circuits are in phase. When *P* rotates "astern" one circuit is 180° electrically out of phase with the other.

The indicators or voltmeters have two coils, the moving coil to which the pointer is attached and a fixed or field coil. The field coil is connected electrically to one of the magnetos and the fixed coil to the other. When the two magnetos are in phase, that is, when the shaft *P* is running "ahead" the deflection is to the right, and indicates revolutions per minute "ahead."

When they are 180 degrees out of phase the pointer is deflected in the opposite direction, or to the left, indicating revolutions per minute "astern." The faster shaft *P* turns in either direction the higher the voltage generated and the greater the deflection of the pointer calibrated to conform thereto.

Fig. 3 shows the engine room type, which instrument has a very long scale and prominent pointer. It may be read from a distance of twenty or thirty feet and when placed in line of vision of the man at the throttle enables him to bring his engine quickly and accurately up to any desired speed.

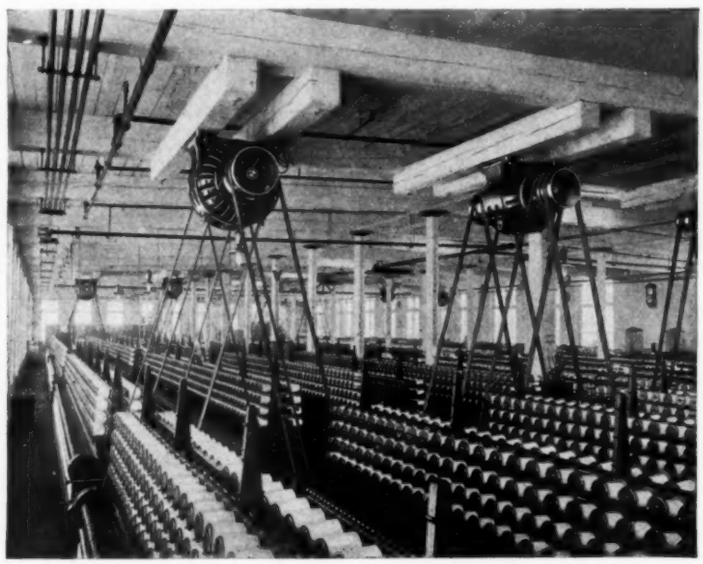
FIG. 3.—HUTCHISON ENGINE ROOM TYPE ELECTRIC TACHOMETER.

The Induction Motor and the Four-Frame Textile Mill Drive.

The present day tendency toward the economical powering of textile mills and the adapability of an induction motor to this industry are conspicuous features in the new and modern mills which are being erected and equipped in the South. The accompanying illustration shows the motor application which has become practically standard in spinning and spooling departments. This application is known as the four-frame drive, and consists of two pulleys mounted on each end of the rotor shaft of the motor, each being connected to a separate frame by a belt. This method of drive is especially desirable on account of the fact that the motor load is made more even. It is often required to stop and start certain machines very frequently, and on this account a motor sufficient to carry the varying load without injury is altogether too large and expensive for steady running at a load smaller than the one for which is was designed. By grouping these machines in fours, so as to be operated by one motor, the demand on the motor is evened up, and it is made to operate at its most efficient load. The four pulley attachment also does away with the countershaft and extra belting, and therefore, frees the ceilings from obstructions which shut out the light. In all cases the motors are rigidly suspended from the floor beams, so that they are out of the way and free from the dust and dirt of the operations.

The illustration is taken from the mill of the Dunn Manufacturing Company at Gastonia, N. C. The motors used in this mill are three-phase, sixty-cycle, 550-volt, Hawthorn induction motors manufactured by the Western Electric Company, of Chicago and New York. Power is received from the Southern Power Company, and is transformed from the transmission voltage of 2,200 by three 125-kilowatt transformers to the operating voltage of 550.

The mill is of the latest design, and provided with a sprinkler system for fire protection and also other precautions, so as to fulfill underwriters' specifications for low insurance rate. All wiring is run in conduit, and the induction motors, which are free from commutations and the attendant sparking, afford a reliable and efficient power system.



VIEW OF SPOOLING ROOM IN TEXTILE MILL SHOWING APPLICATION OF WESTERN ELECTRIC MOTORS.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 28.—The following new companies have been formed in France: At Paris, the Hebrun & Jeay firm, engaged in the manufacture of electric supplies; the Compagnie Industrielle for luminous signs and similar apparatus; L. Hamm et Cie., for industrial applications of electricity; Societe Centrale for electrical industry; Chercholy & Caravillet, electric lighting apparatus. The firm known as De la Vallée, Poussin et Cie., is to build and operate hydraulic plants in connection with the nitrous product industry. At Lyons, I note the firm of Thos. Fauvain et Cie., for electric power distribution. In the Mediterranean region there has been formed the Cote d' Azur Electric Tramway Company, at Cannes.

An electric tramway system has been recently opened for service at Lille, France, and it includes a number of sections running through the town. On the section which passes along the boulevard which is designed to carry the heaviest traffic at a high speed, the cars are of large size and are fitted with 160 horsepower in motors. Catenary suspension is used for the trolley wire on this line, using 100-foot span in general.

There is shortly to be erected a turbine plant on the Ariege River in France, which will be used in connection with an electrolytic plant for the manufacture of chemical products. The Ariege Hydraulic Company has already secured the rights for erecting the plant.

The Amiens Industrial Society offers prizes for 1909-1910 in the shape of gold and silver medals for different inventions in the electrical field. One of these relates to a generator of current by mechanical, chemical or thermic means, which will give the best yield and economy. A gold medal will be given for a storage battery which is to be shown in working order, this to be superior in yield, rapidity of charge and other points, also an incandescent lamp which is superior to the ordinary and can be made for all voltages up to 250. An improved fuse block is also on the list.

In order to connect Wissemburg with Lindau there is to be built an electric traction line which will run by way of Bergzabern. The road is to be constructed and operated by two different companies which have been formed for the purpose, one at Munich and the other at Bremen, but it is likely that these companies will unite in a single one in the near future.

In Italy an electric traction line is to be built from Trani to Corrato, and the concession has already been obtained from the state. There will also be built a line from Badia to Ripoli and another from Bari to Ceglie. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JANUARY 8.—The Cataract Power Company, of Hamilton, Ont., has again passed a dividend, which approximates $113,000 this year. This money will be used to fix up the street railway system.

Mexican Power earnings, net, for eleven months are $1,302,000 in gold, so that the net for the year, under ordinary conditions, will be $1,500,000. With fixed charges and preferred dividends absorbing $1,248,000, the balance for common stock dividends is $252,000, leaving a deficit below the amount to be paid by $291,000.

The contract for increasing the capacity of the generating plant of the Montreal Light, Heat and Power Company, at Lachine Rapids, has been awarded to Morgan, Smith & Company, of York, Pa. The improved plant, which entails the expenditure of about $175,000, will increase the capacity of the power house by 5,000 horsepower.

The plans for the development of power at the Long Sault Rapids in the St. Lawrence, at Cornwall, Ont., are now before the chief engineers of the three departments of the Dominion Government having oversight in the matter, the departments of canals, marine and public works. Elaborate plans and drawings, in detail, have been filed and they show three distinct dam proposals, each with a different elevation. The engineers will advise the government in respect to them, and the government will then decide which plan will be followed. Four power houses, three on the American side of the river and one on the Canadian side, are shown, and, roughly speaking, about 125,000 horsepower is proposed at the outset. This may be largely increased. The plans will also go before the International Waterways Commission for approval.

The Montreal Street Railway Company is understood to be considering a carefully elaborated plan for electric subway traction in the central portion of the city of Montreal. An expert report on the project has been prepared and will be considered by the chief officers of the company, together with Senator Forget and some officials of the Power and Shawinigan companies. The project is dependent upon the consummation of the long discussed merger of the Street Railway, Montreal Light, Heat and Power and Shawinigan Power interests, as the Street Railway is disinclined to go into such an enormously expensive undertaking alone. The allied power companies would be enabled to use the subway for their main transmission lines. The more important consideration to them, however, would be the control of all future developments in the way of underground traction, ensuring that no rival electric company would be able to get the subways as a customer for power. It is rumored that the proposal is to build a six-track subway from the eastern end of the city to the western end, taking in all the railway stations. British capital is said to be behind the scheme which will necessitate an investment of $100,000,000.

The problem of cheaper telegraphic communication between Great Britain and Canada is about to be solved, although not in the way first anticipated. Some months ago all that remained to be done to bring about cheaper cable communication was to reach an agreement with the land telegraph companies in Canada. These companies, however, arrayed themselves in opposition, and the government of Canada found itself either unable or unwilling to force the hands of the telegraph combine. There was no difficulty experienced in this direction in Great Britain, where the land telegraph lines are the property of the government. The Marconi Wireless Company is now in the field. This company has found it impossible to do business in Canada, owing to the opposition of the land telegraph lines on this side of the Atlantic. These refuse to transmit the marconigrams sent across the ocean to the Marconi station in Nova Scotia to points in the Dominion. However, the Marconi company will establish over a score of stations at principal points throughout Canada to which messages from Great Britain can be transmitted by wireless telegraph. Thence to the less important points messages may be transmitted by the telephone. It is understood that this new system will be in operation by early spring. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, CAN., JANUARY 3.—The town of Fort Saskatchewan, Sask., has purchased the electric light and power plant from the local company, of which O. Higman was the general manager.

The City of Red Deer, Alta., is considering an offer to purchase the General Western Electric Company's plant which supplies light and power to that city. Address H. H. Gaetz.

Walter-Fyshe Company, of Montreal, Que., have been awarded the contract for the general work in connection with the plant to be erected at Calgary, Alta., by the Calgary Power and Transmission Company. Construction will start in the spring.

The High Falls Power Company, of Cobalt, Ont., has issued a circular offering to supply the town with electric light at rates considerably less than those now charged. The company will shortly be in a position to supply this power.

The Glen Ewen Telephone Company, of Glen Ewen, Sask., has been incorporated to construct a rural telephone system at that place. The incorporators are all local men.

The Kootenay Telephones, Ltd., of Cranbrook, B. C., is considering the advisability of building a line from Kamloops to Grande Prairie and, in the meantime, is rushing work on the lines to connect its system with that of the Alberta Government.

T. R. Nickerson & Company has been awarded the contract for building five substations for the British Columbia Electric Railroad Company in connection with its line between New Westminster and Chilliwac. The price is $225,000, and work will start at once.

Work on the rural telephone lines in Manitoba has been seriously delayed during the end of last year on account of the scarcity of labor.

The ratepayers of Revelstoke, B. C., voted in favor of installing a municipal electric light and power plant.

Simpson & Craig, of Virden, Man., are installing telephone systems in Melville and Hanley for the Saskatchewan Government.

The Nelson Street Railroad Company has been organized at Nelson, B. C., to supply that city with an electric street railway system. A twenty-year franchise has been granted.

The General Electric Manufacturing Company of Sweden is supplying the Calgary Power and Transmission Company, of Calgary, Alta., with four 750-kilowatt water-cooled, step-down trans-

formers. Smith, Kerry & Chace, of Toronto, Ont., are the consulting engineers.

Conduits are being laid in Portage la Prairie, Man., for the telephone and electric lighting wires. When poles are necessary side streets and lanes will be used as much as possible.

The municipal council of Burnaby, B. C., authorized the British Columbia Electric Street Railroad Company to construct electric car lines through that municipality. R. H. Sperling, of Vancouver, B. C., is general manager of this system.

The Grand Trunk Pacific Railroad Company is now operating over 1,000 miles of telegraph lines in Western Canada and expects to double this mileage before the end of the year. A. B. Smith, Winnipeg, Man., is superintendent of the company's telegraph system.

A Marconi wireless telegraph office has been opened at Gonzales Hill, in the vicinity of Victoria, B. C.

The Hinton Electric Company, of Victoria, B. C., has been awarded the contract for the installation of fire alarm systems and bells in all the public schools of that city.

Mayor Jamieson, of Calgary, Alta., states that the power contract between the city and the Calgary Power and Transmission Company has not yet been definitely settled, but it is anticipated an agreement will be arrived at.

The municipal power plant at Lethbridge, Alta., was destroyed by fire and consequently the city was in darkness for several days, and there is no relief in sight until new machinery is received.

Immediately after the break down of the plant of the Winnipeg Electric Company, which supplies Winnipeg, Man., with light and power the British Columbia Electric Company decided to build an auxiliary plant in the vicinity of Vancouver, B. C. The company has voted $6,000,000 for this and other work in Vancouver this year. Any inquiry should be addressed to R. H. Sperling, general manager, Vancouver, B. C.

The farmers in the Colleston district, north of Prince Albert, Sask., have decided upon a rural telephone system, work on which will be started early in the spring. George Reid, who is in charge of the system, can be addressed at Collaston, P. O., Prince Albert, Sask.

A syndicate is being formed at Calgary, Alta., to develop 20,000 electrical horsepower in the vicinity of that city at a cost of $1,500,000. Work will be started in the spring. Any one interested in the development of this power should address R. R. Jamieson, Calgary, Alta.

Electrolysis has done so much damage in Winnipeg, Man., to the civic water mains that the Winnipeg Electric Company, which operates the car system, will lay return feeders from the central portion of the city to its substations. Work will be commenced early in the spring. Wilford Phillips is to be general manager.

Sealed tenders will be received by Magnus Peterson, secretary of the civic board of control, Winnipeg, Man., for the following works and supplies in connection with the civic power plant now being built at Lac du Bonnet at a cost of $3,500,000: terminal station, stepdown transformers and terminal station switching and accessory apparatus, terminal station light, heat and power systems, terminal station oil and water systems, testing transformers and apparatus, seven turbine governors, two five-foot gate valves. Tenders close February 15. All bids must be accompanied by a check for ten per cent of the amount. Further particulars may be obtained from Cecil B. Smith, civic power commissioner, Winnipeg, Man.

The Government of Alberta has prepared its construction programme for the year, which includes the building of some 800 miles of long-distance telephone lines in addition to the erection of a number of local exchanges.

The Canadian Pacific Railroad is gradually getting its telephone system installed. The systems between Winnipeg and Brandon, Man., and between Fort William and Cartier, Ont., which have been in operation for several weeks, have been pronounced by the officials an unqualified success. The telephone dispatcher's system is expensive to install, but its manifold advantages are so apparent that its extension is merely a matter of time. This system has already been worked over the telegraph wires between Winnipeg and Fort William, but in the spring the company will install special telephone wires over this distance of 426 miles, making a total of 1,044 miles of telephone lines in operation. The telephone apparatus at the depots resembles that in the city exchanges, but the bell is a large gong so there can be no chance of a call escaping notice. In case of an accident any one can go into the nearest depot and telephone for assistance, in this way immediate communication can be had even if there is no telegraph operator around, as sometimes happens at small stations along the line. The train hands also carry a long pole with which connection can be made at any point en route with the telephone wires by simply placing it against one of the lines. R.

MEXICAN POWER DEVELOPMENTS.

(Special Correspondence.)

The Chapala Hydroelectric and Irrigation Company's plans for invading the electric power field of this part of Mexico are developing rapidly. The company recently entered into a contract with the state government of Aguascalientes for furnishing power for mines and industries in that state. This contract gives the company the exclusive right to occupy that extensive field. It has acquired the electric street railway and the light plant in the city of Aguascalientes. It will build a transmission line from its hydroelectric plant on the Santiago River to Aguascalientes and the principal mining districts of that state. The company is also negotiating for similar concessions from the state governments of San Luis Potosi and Zacatecas. The longest of these proposed transmission lines will be about 180 miles. In the city of Aguascalientes the company agrees to deliver power at a rate of not exceeding $100 per horsepower per annum and not more than $125 per horsepower per annum in the mining camps. It already has two hydroelectric plants on the Santiago River and is building a third. It will increase its facilities by building a canal about fifteen miles long, which will bring its available horsepower up to 90,000. It expects to have its transmission line completed into the mining districts west of Guadalajara in a short time.

The Mexican government has granted the Mexican Northern Power company, which has its headquarters at Montreal, Canada, a new concession authorizing it to construct a second dam and hydroelectric plant on the Conchas River in Chihuahua, near the town of La Joya. This company is already building a dam across the Conchas at Boquilla, seventeen miles above Santa Rosalia, and is constructing a railroad from Santa Rosalia to the site of the dam and proposed hydroelectric plant. The first dam will give the company sufficient water supply to generate about 30,000-horsepower. The plant at La Joya will be equally as large.

The Compania Electrica e Irrigadora, which is now operating two hydroelectric plants near Pachuca, Hidalgo, each of 6,000-horsepower, is constructing a canal about twenty-five miles long to afford the waterpower for a third plant which it will erect at Tetepango. The company is furnishing many of the mines and mills in the Pachuca district with power.

The contract for the construction of the first of the large dams across the Mayo River in the state of Sonora and for the erection of a hydroelectric plant will be let soon after the first of April by the Mayo River Power and Land company, which has its headquarters at Denver, Col., according to the announcement of W. O. Temple, secretary of that company. The company will build two more dams on this river, both of the latter to be in the state of Chihuahua. It will build a system of electric transmission lines to the mining districts and industrial towns of that part of Mexico.

It is announced by Dr. F. S. Pearson, head of the Mexican Light and Power company, that the great Necaxa dam will be finished about July 1. Next to the Gatun dam on the Isthmus of Panama it will be the largest dam of its kind in the world. It will bring the hydroelectric capacity of the company up to 100,000 horsepower. An additional 32,000 horsepower will be had by 1912. When the demand for power reaches this capacity a second power plant of 100,000 horsepower will be built below the Necaxa Falls.

The Batopilas Mining company will erect a hydroelectric plant on the Batopilas River near Batopilas to give power for its mines and mills. The river has a fall of 1,000 feet at that point. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DEVELOP PIT RIVER POWER.—A company has been organized with a capital of $1,000,000, under the name of the Shasta Power Company, to develop electric power from Pitt River in Shasta County, Cal. It is proposed to construct dams and erect machinery for the generation of electricity. Probably $2,000,000 will be expended in developing the rights taken over. The company has been formed to combine the interests of a number of owners of water rights on Pit River. Those most largely interested in the project are John Coffee Hays of Visalia, William A. Cooper and R. C. Johnson of San Francisco, H. V. Gates of Hillsboro, Cal.

POWER PLANT AT SOUTH EDWARDS, N. Y., NEAR COMPLETION.—The hydroelectric power plant on the east branch of the Oswegatchie River is nearly finished and the concrete dam and overflow dams are ready for the plant to begin work. High tension power lines have already been built to the mill of the Diana Paper Company at Harrisville. The dam of this power plant is sixty-two feet in height, and has been erected in a narrow, rocky gorge, at what is known as the Long Sault Falls. It is expected that the dam will set the water back a distance of between two and one-half and three miles, forming a great storage reservoir which will insure a constant maximum flow of water throughout the year for the power house below. About 3,000 horsepower will be generated when the plant is in full operation.

POWER DEVELOPMENT IN NORTH CAROLINA—The most promising field for electrical development in the Southern states at this time is that of textile development. During the past year many scores of mills have signed contracts for electric power from the various new electrical development concerns that are being built up over the Southern states. The use of electricity is gaining ground rapidly as a motive power, and the following statistics for 1909, from the State Commissioner of Labor and Printing, will serve to indicate the extent to which electricity is now in use:

Out of 312 cotton, woolen and silk mills, 118 use steam; 81 electricity; 42 steam and water; 34 water; 28 electricity and steam; 4 steam, electricity and water; 1 uses gas; 3 not reporting. Of the 63 knitting mills, 8 use electricity; 5 gasoline; 1 uses electricity and water, and the others use steam. It is thus seen that while the use of electricity is rapidly growing, there is yet much room for the development of the electric drive. These figures, however, do not include many recent contracts for electric power that could not be incorporated in the report on account of the recentness of plans. The total horsepower used in all mills is over 130,000. The average working day in the North Carolina mills is 10.69 hours. L.

PLANS FOR REBUILDING COLORADO RIVER DAM—J. C. Dumont, an engineer and contractor who is building a large dam across the Colorado River at Marble Falls, sixty miles above Austin, has submitted a proposition to the municipal government of Austin, Tex., for the rebuilding of the great dam across the Colorado. This dam and hydroelectric plant were destroyed by a flood in the river nine years ago, entailing a loss of $1,600,000. The original dam was erected at a cost of $1,000,000. Mr. Dumont, in his proposition, estimates that he can rebuild the dam on new plans at a cost of about $350,000. He agrees to finance the proposition if the city will give him a lease of the water power and the exclusive control of the hydroelectric plant that he proposes to install. He asks that the city make a contract for power with him at the rate of two cents per kilowatt-hour and that it install motors at its water-pumping plant. The proposed contract allows the city to make sub-contracts with consumers for the use of electric power at whatever profit it may see fit. Mr. Dumont reserves the right, however, to build transmission lines and to furnish power to outside points and industries at a rate not to exceed three times that which he charges the city of Austin. At the expiration of fifteen years the lease expires and the dam and hydroelectric plant passes into the hands of the city. It is probable that Mr. Dumont's proposition will be submitted to a vote of the people of Austin. D.

LIGHTNING AND POWER.

(Special Correspondence.)

BLUE STONE, N. Y.—A plant has just been completed here to furnish the city with light and power.

MOORHEAD, MINN.—The light and water plant under municipal ownership shows a profit for year of $13,560. C.

FARGO, N. D.—A vote will be taken January 28 on issuing bonds for $90,000 for electric light and filtration plants. C.

COLUMBIA FALLS, MONT.—The council has granted an electric lighting franchise to the Northern Idaho & Montana Power Company. C.

WILLOW LAKES, S. D.—A franchise has been granted to Thomas & Felix for the installation of an electric lighting plant at this place. C.

WHITEFISH, MONT.—The Big Bend Light and Power Company, which owns and operates the electric light and telephone system in this city, has sold its interests to the Northern Idaho & Montana Power Company. C.

HOLLYWOOD, CAL.—The Board of Trustees has adopted a resolution authorizing the installation of four miles of additional street-lighting service, including eighty lights, copper service wire and tungsten lamps, at a total cost of $11,600. A.

GRAND FORKS, N. D.—Earl Jackson, engineer, St. Paul, Minn., has prepared plans for the proposed changes in the electric light plant. They include a 250-horsepower boiler, new engine, condenser, stoker, wiring, etc., estimated to cost $12,000.

LODI, CAL.—George E. Lawrence, chairman of the Board of Trustees, is in San Francisco negotiating with the different power companies relative to purchasing electric current for this city. The American River Company will probably get the contract.

SYRACUSE, N. Y.—The North Syracuse Light and Power Company has been organized for the purpose of furnishing light and power to North Syracuse. Directors have been elected as follows: W. J. Conway, Chas. R. Ferguson and Chas. L. Jackson.

REDDING, CAL.—The Mountain Copper Mining Company has closed a contract with the Northern California Power Company to build a heavy power transmission line from this city to the Keswick Smelter. The line will be constructed at a cost of approximately $150,000. A.

CARTHAGE, N. Y.—The Carthage Electric Light and Power Company has recently ordered a new 560-kilowatt generator for its plant at Fly Falls above Belfort, which will be installed about March 1. This will be the third in the plant, the other two being of 400 kilowatts each.

SPRINGFIELD, ILL.—Plans for the double tracking of West Monroe Street and the construction of a new line out Fifteenth Street to Laurel are considered by the street railway company. Other improvements, to be installed in the spring, will entail a total expenditure of $200,000.

MONTERREY, N. S.—The Monterrey Street Railway, Light and Power Company is making arrangements for the installation at its plant of a new steam turbine. This will be the third and will add greatly to the efficiency of the plant, which is already one of the most complete in the republic.

SALT LAKE, UTAH.—Frank L. Capening, of Provo, Utah, has applied for the privilege of appropriating 5,000 acre-feet of water from Sanpitch River and Six-Mile Creek for power and irrigation purposes. Mr. Capening and his associates plan to raise the height of the Gunnison dam ten feet and to store all of the surplus waters of the streams named. A.

NORTH BALTIMORE, O.—Announcement has been made by Dr. A. G. Henry, proprietor of the electric-lighting plant, that service will be discontinued until March 1. This includes residences, business houses and street lamps, the city being in total darkness. Lighting bills amounting to $715 have been held up by the City Council for some time, which is assigned as the reason for the action. H.

SEA CLIFF, N. Y.—The Board of Trustees of the village of Sea Cliff has awarded to the Nassau Light and Power Company of Roslyn a three-year contract for lighting. Bids were received from the Nassau Light and Power Company and the Nassau Gas Construction Company of Glen Cove. The rate of lighting will be $15 per lamp per year for tungsten incandescent electric street lights as now used.

TOLEDO, O.—The Whipple-Strubb Electric Company has been incorporated at Toledo by Charles W. Whipple, Jacob W. Strubb, Wm. R. Dohm, W. T. S. O'Hara and C. E. Kachenmeister The concern has a capital stock of $10,000 and will do a general electric business, taking over the old plant of De France & Strubb at Monroe and Michigan streets. Jacob W. Strubb will be the president of the new company. H.

CHICO, CAL.—When the City Trustees met recently to open bids for the city lighting the only bidder ready to bid was the Pacific Gas and Electric Company. F. P. Bergen, superintendent of the Sacramento Valley Power Company, stated that his company would reach Chico with its power line by the middle of February or the first of March, and the opening of bids was accordingly postponed till a later date.

SYRACUSE, N. Y.—Incorporation papers have been filed by the North Syracuse Lighting Company and franchise to operate in the towns of Clay, Cicero and Salina will be asked. The directors of the company, which is capitalized at $5,000, include William J. Conway, Charles R. Ferguson, C. L. Jackson, W. C. Franklin, George Weller, J. Irving Freeman and Andrew Hamlin. The company will get its power from the South Bay Railroad.

ROYALTON, VT.—Articles of incorporation have been filed by the Royalton Power Company, which has been organized for the purpose of supplying current for light and power and for carrying on a general contracting business in Royalton, Bethel and surrounding towns. The capital stock is given as $16,000, and the incorporators are, Frederick L. Walker, of Boston, N. Curtis Fletcher, of Boston; Robert B. Keltie, Jr., of Boston; Marvin H. Hazen, of South Royalton, and Arthur U. Stoughton, of Royalton.

ST. PAUL, MINN.—The Washington County Light, Heat and Power Company has filed notice of an increase of capital stock to $10,000,000. The name is also changed to "Consumers' Power Company." The company was organized in June with a capital of $100,000 and nothing has been said previously regarding the increase of capital stock. Extensions will probably be made with a view of supplying White Bear, North St. Paul and the entire lake district. A new power plant is to be built near the Apple River dam. Archie S. Huey is president, and R. J. Graff, secretary, of the new company.

PUEBLO, COL.—The electric light plant of this city is to be again enlarged for the second time this year and as soon as the work is completed the company will be in a position to furnish day current for power purposes. Another addition will be made to the building and more complete and up-to-date machinery installed. Part of this improvement was made necessary by the large contract with the Rio Grande shop department to furnish current to run the heavy shop machinery. When the plant is completed it will supply sufficient equipment to run the San Luis Valley.

TIFFIN, O.—The Tiffin Electric Company, a concern recently incorporated with a capital stock of $500,000, has absorbed the Tiffin-Edison Electric Illuminating Company and the Consolidated Gas and Light Company, the two electric plants here. Announcement has been made of a reduction in rates of two cents per kilowatt-hour. The officers of the new company are: President, R. E. Breed, Marion, Ind.; vice-president, George N. Tidd, Elizabeth, N. J.; secretary, John H. Ormond, Toledo, O.; treasurer, Frank B. Ball, Plainfield, N. J. Frank Espy will have entire charge of the plant. H.

TRINIDAD, COL.—The Colorado Light, Heat and Power Company has been incorporated to take over the property of the Southern Colorado Power and Railway Company, of Trinidad. This power company is the result of a combination of the Trinidad Street Railway Company, the Los Animas Light and Power Company and the Stonewall Jackson Railroad. The new company, organized by Brown Brothers, of New York, is capitalized at $5,000,000. It is expected that the capacity of this plant will be increased from its present 1,500-horsepower to 15,000-horsepower, which will be sufficient to supply Trinidad and the surrounding district with light and power.

SYRACUSE, KAN.—This city has voted bonds for the construction of an electric lighting plant. P.

RALSTON, OKLA.—This city will soon begin the construction of its own electric light plant. P.

HETTINGER, N. D.—The Hettinger Electric Power Company has applied for a franchise in this city. P.

MONROE, WIS.—H. Smith has become the manager of the Monroe Electric Light and Power Company. P.

CHAMAL, TAMAULIPAS, MEX.—Plans are now under way for the erection of a municipal electric lighting plant here.

WINNECONNE, WIS.—The Winneconne Heat, Light and Power Company has recently been incorporated with a capital of $10,000. P.

CHARLESTON, MO.—The Southeast Missouri Light, Ice and Power Company has been incorporated with a capital stock of $15,000. P.

STILLWATER, MINN.—The Washington County Light and Power Company has increased its capital stock from $100,000 to $1,000,000 and will extend its operations to other cities. P.

ALAMOGORDO, N. M.—The Alamogordo Consumers' Light and Power Company has been organized here by George Carl and others for the purpose of erecting an electric lighting and power plant.

SOUTH NORWALK, CT.—This city is preparing to build a new municipal light plant to cost $100,000. The plant, which has been for some years in use, was profitable to the city, but is now inadequate.

SAN FRANCISCO, CAL.—The City Electric Company, which recently installed a 12,000-kilowatt steam generator, has declared a dividend of twenty-five cents per share on the issued capital stock of the company.

DENVER, COL.—The mortgage of $25,000,000 on the Denver Gas and Electric Company has recently been recorded. The bond issue which this mortgage covers was approved at the time of the reorganization of the company a few weeks ago.

TACOMA, WASH.—Weil, Roth and Company, of Chicago, recently purchased the $100,000 bonds of the Tacoma Light and Power Company. This was the last of a bond issue of $300,000, authorized by the city to pay the preliminary cost of its Nisqually power plant.

MINNEAPOLIS, MINN.—Major Charles S. Riche, chairman of the government board of engineers, states that a proposal has been received from a private party, supposed to be the General Electric Company, for the construction of the high dam in the Mississippi River near the Soldiers' Home, which appears to be very favorable to the United States. C.

PUEBLO, COLO.—The Colorado Railway, Light and Power Company has filed articles of incorporation. The company will operate in Denver, Huerfano, Las Animas, Fremont and Pueblo counties. The capitalization is $5,000,000. The new company is the successor to the Southern Power Company. It will take over the power plant at Trinidad and will enlarge it.

ALBEMARLE, N. C.—The Southern Power Company is erecting its transforming station to the rear of the Wiscasset Mills Company. C. F. Brown, of the Dixie Concrete Company, of Greenville, S. C., is superintending the work. It is expected that machinery and equipment will be installed by the first of February, so that the new cotton mills may be supplied with electricity as needed.

LYONS, N. Y.—It is reported that the gas and electric company of this village will make improvements as soon as spring opens. Lyons will be headquarters for electricity. In addition to supplying Clyde, it is said, both Newark and Palmyra will be served from the plant here, which is to be remodeled in the spring. The local plant will be increased in size and up-to-date electrical equipment will be installed.

CHILLICOTHE, MO.—The proposition to bond the city of Chillicothe for $50,000 to build an electric light plant carried by a majority of nearly 500 votes at the election recently held. The city has been without street light for eighteen months. Jones & Hovey, of Independence, Ia., are the owners of the present light plant. The new light plant, according to consulting engineer William Fuller, of St. Louis, will be completed and ready for operation next spring.

WEST NEWTON, PA.—The municipal electric lighting plant has been sold to the West Penn Electric Company, the consideration being $14,000. Included in the sale is a five-year contract, by means of which the new owner agrees to furnish light to this city at the rate of $70 per arc lamp for a period of five years. The plant has been in operation for seventeen years. It is the intention of the West Penn Electric Company to carry one of its branch lines into West Newton.

RIFLE, COL.—The construction work on the power plant of the Rifle Light, Heat and Power Company has recently been furnished and the plant put in operation. The plant derives its power from Rifle Falls, which have a vertical drop of eighty feet and could develop about 1,200 horsepower, although the present plant only generates 300 horsepower. The officers of the company are: C. L. Todd, president; Dr. W. J. Le Rossignol, vice-president; W. M. Haley, treasurer; E. McLearn, local manager.

ABERDEEN, S. D.—Gilborne Brothers have applied for a franchise for an electric light plant. P.

HUSTISFORD, WIS.—The Hustisford Electric Light and Power Company has filed articles of incorporation with a capital stock of $40,000. The incorporators are: O. E. Dehne, C. W. Erdman, Jr., and E. Dehne.

SALEM, ORE.—Governor Benson has ordered money set aside for the installation of an electric-lighting system in the state penitentiary in this city. The institution is at present lighted with coal-oil lamps.

PHOENIX, ARIZ.—The City Council has passed a resolution instructing the city attorney to take the steps necessary to secure from Congress permission to establish a municipal electric-lighting system. The plant will cost from $200,000 to $300,000. A.

SEATTLE, WASH.—The City Council has directed the controller to advertise for sale bonds of the city to the amount of $200,000 for the purpose of enlarging and extending the municipal lighting plant. This is part of the issue of $800,000 in bonds recently authorized. The remainder of the issue will be sold as the money is needed. A.

GUTHRIE, OKLA.—The Utility Gas and Electric Company of El Reno, which is to furnish electric power to the El Reno-Oklahoma City Interurban Electric Railway now in course of construction between those cities, has incorporated with a capital stock of $1,000,000. The directors are: H. H. Stephens, W. H. Criley, C. C. McVay, F. W. Van Ness and Lydia McBryde, all of El Reno.

OAKLAND, CAL.—The People's Electric Light and Power Company has been incorporated in San Francisco with a capital stock of $500,000 by D. U. Toffelmeier, J. H. Hornung, C. A. Sprout, F. H. Woodward and W. H. Spalding. The company is an adjunct of the Great Western Power Company, operating a large plant on the Yuba River, and will act as a distributing agency for the latter company. A.

MEMPHIS, TENN.—Construction of a hydroelectric plant and a cotton mill at Edwin is intended by O. P. Heath & Company, of Charlotte, N. C., who have purchased and will develop the "Devil's Looking Glass," near Erwin. This power property is estimated to be capable of furnishing 3,000 horsepower for transmission by electricity, which will be used for operating the mill and for lighting and power in the vicinity.

COLORADO SPRINGS, COLO.—Plans involving the expenditure of something over a million dollars, were ratified at a recent meeting of the Guanajuato Power and Electric Company. It was voted to increase the capital stock of the company from $3,500,000 to $5,000,000. The officers of the company are: Henry Hine, president; Leonard E. Curtis, vice-president and treasurer, and Irving Bonbright, secretary, all of Colorado Springs.

ERWIN, TENN.—O. P. Heath, of Charlotte, N. C., will build a large hydroelectric plant and a cotton factory at Erwin, Tenn. It is expected to develop 3,000 horsepower for transmission by electricity to the mill for power and light and to other industries in and near Erwin, besides lighting that town. The power to be developed is known as the Devil's Looking Glass, and it is on the Nolachuckey River. The firm in which Mr. Heath is interested has purchased this power property and various nearby lands, the latter costing $18,000.

LOUISVILLE, KY.—Plans for a new power station to cost more than a quarter of a million have been perfected by the officers and directors of the Kentucky Electric Company. The new plant will be erected on a site immediately back of the large power station on Washington Street, between Second Street and Third Avenue. According to Robert E. Hughes, the president of the Kentucky Electric Company, work will begin on the new station as soon as the twin tunnels running underground from the river to the site are finished. Mr. Hughes expects to see them ready for use by May 1.

ST. JOHN, N. B.—J. Norman Winslow, who was appointed by the Provincial Government to investigate and decide the amount of security which the Grand Falls Power Company must give before proceeding to expropriate property required by them at the Falls, has named $300,000, based on the calculation that these falls would produce 38,000 horsepower. The government will now consider whether it will give the company an indemnity bond at the amount named, or refuse it. The company is composed of American capitalists, and there have been rumors that it proposed to transmit power across the international boundary to operate mills in Maine.

BELLINGHAM, WASH.—The Whatcom County Railway and Light Company will soon start the construction of the large brick building which is to be used to house the machinery for the auxiliary power station that is to be built to relieve the power plant at the Nooksack falls during the winter months. Manager L. H. Bean states that the local station will be completed by next August and the total cost of the building will be approximately $274,000. At the present time the company has a small auxiliary plant which has a capacity of about 1,500 horsepower, but this is too small to furnish the light and power that are needed in most emergency cases. When completed the plant here will have a capacity of about 4,500 horsepower. The machinery that is to be installed will generate 3,000 horsepower.

MARBLE, MINN.—The Oliver Mining Company will install an electric lighting plant for the town. P.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WATERLOO, IOWA.—The construction of an interurban road to Oskaloosa, by way of Dysart and Belle Plaine, is projected. C.

MONTESANO, WASH.—The survey has been commenced for an electric line to Grays Harbor to be built by the Grays Harbor Interurban Company. C.

CLARINDA, IOWA.—A tax of six per cent has been voted for the completion of the Iowa & Southwestern railroad to Clarinda, College Springs and Blanchard. C.

BOLIVAR, N. Y.—It is proposed to build a trolley line between this city and Wellsville, a distance of fourteen miles. The probable cost of construction would be $10,000 per mile.

LITTLE FALLS, MINN.—Local business men are agitating the construction of an electric railway through Long Prairie to Alexandria. Henry Diebel, of Long Prairie, Minn., is interested. C.

YANKTON, S. D.—Farmers along the Platte extension of the Milwaukee road west from here, have started an agitation looking to the immediate construction of an electric line to this city. C.

DANVILLE, IND.—The Circle Railway Company is preparing to begin on the construction of a traction line to connect seven county seat towns all located about twenty-five miles distant from Indianapolis. S.

SIOUX CITY, IOWA.—C. A. Magee has asked the council for a franchise for an electric line he proposes to build to Parkston, S. D., passing through Sioux Falls, Freeman, Yankton, Centerville and Elk Point, S. D.

LOGANSPORT, IND.—The South Bend & Logansport Traction Company has filed amended articles of incorporation with the secretary of state increasing the capital stock to $400,000. There will be no preferred stock issued. S.

KALISPELL, MONT.—The Whitefish & Polson Electric Railway Company has been incorporated by G. H. Adams, J. H. Stevens and others, with a capital of $200,000, to construct an electric line from Whitefish, by way of Kalispell, Somers to Polson. C.

SALT LAKE CITY, UTAH.—The Utah Light and Railway Company is contemplating the installation of an additional motor-generator in the central station for the street car system. It will be a 4,000 500-volt machine with a capacity of 1,500 horsepower and will cost about $35,000. H.

SAN BERNARDINO, CAL.—It has been definitely announced that work is soon to be begun on the Riverside-Rialto electric road and franchise bids are to be opened on January 24. The road will serve the entire district west of this city and may eventually connect with the county seat.

COLUMBUS, IND.—The farmers of Bartholomew, Decatur and Wayne Counties are taking great interest in the matter of constructing the Columbus, Greensburg and Richmond Traction lines, and will take one-third of the bonds issued by the company. A. M. Kuhn, of Indianapolis, is president. S.

SHAMOKIN, PA.—Monroe H. Kulp, principal controller of the Edgewood Park Trolley Company, has conferred with representatives of Meikleham & Tinsmore, New York bankers, concerning the merging of the line with a number of other coal region trolley companies. It is expected that the plan will be consummated.

BROOKSTON, IND.—Surveyors are at work locating a route for an interurban road to be built from Battle Ground to this city and Reynolds by the North Western Traction Company. The line will be twenty-five miles long and connect with the Ft. Wayne and Wabash Valley Traction Company's line at Battle Ground. S.

WABASH, IND.—The Miami Construction Company which has the contract to construct an interurban line from this city to Warsaw, is receiving six carloads of steel rails per day, and track laying will proceed rapidly as soon as warmer weather prevails. Sixty thousand dollars in subsidies awaits the company on completion of the road. S.

PITTSBURG, PA.—The Charleston Interurban Railways Company, of Charleston, W. Va., recently formed with $400,000 capital, has taken over the properties of the Kanawha Valley Traction Company. The new company has been organized with W. E. Chilton, president; W. A. McCorkle, vice-president; F. M. Staunton, secretary and treasurer.

MONTICELLO, IND.—The Tippicanoe & Monticello Interurban Company has completed plans to begin work constructing thirty-six miles of road connecting Monticello, Idaville, Sitka, Buffalo, Hedley, Pulaskiville and Winamac. Either gasoline or electric power will be used in operating the cars. William R. White is secretary and general manager. S.

ST. PAUL, MINN.—A mortgage has been filed by the Twin City & Lake Superior Railway Company for $4,000,000. Of this amount $250,000 is to be at once issued in bonds. The filing of this mortgage, which is held by the American Trust and Savings Bank of Chicago, Ill., is taken as an indication that the electric line between the Twin Cities and Superior and Duluth is soon to be finished.

SCOTTSBURG, IND.—J. E. Greeley, president of the Cincinnati, Madison and Western traction line, announces that the contract has been let and work will commence April 1 on the construction of a line from Scottsburg to Madison. The road will ultimately be extended to Cincinnati on the southeast and to French Lick and Salem on the northwest. S.

BANGOR, ME.—The promoters of the Portland, Lewiston & Gray Electric Road have made all arrangements for the construction of the road and the work will soon commence and the road be pushed forward to completion during the summer or early fall months. Settlements have been made in nearly every case where land has been bought for the right-of-way, the road has been surveyed and the construction work is to be hastened as rapidly as possible.

PLYMOUTH, IND.—It is reported that the half-million bond issue of the South Bend & Logansport Traction Company will be put on the market some time in 1910. Contracts for work on the line are being let to three contractors, the southern part of the line, with the terminal in this city, being let to the Triad Engineering and Construction Company. The Illinois Steel Company has received the contract for the rails, but the contract for poles and ties has not been let yet.

HARTFORD, CONN.—The Farmington Street Railway Company, which operates a trolley line from Hartford to Farmington and Unionville, has been formally transferred to the New York, New Haven & Hartford Railroad Company, in accordance with the terms of the recent purchase. The Hartford office of the company will be abolished, and Charles E. Hubbard, who has been general manager of the company since its organization, has retired. The road will continue to be operated from the Unionville end of the line under the immediate direction of Superintendent McCormick.

RUTLAND, VT.—A survey is being made for the extension next summer of the trolley line of the Rutland Railway, Light and Power Company, now running to Fair Haven and Lake Bomoseen, seventeen miles west of this city, to Lake St. Catherine, about twenty-three miles distant from Rutland and southwest of Fair Haven. The survey is being pushed rapidly, with a view to getting all preliminaries arranged so that work may be begun early in the spring and the road completed for summer traffic. The line will run from the east side of Lake St. Catherine to Poultney, in the heart of the slate district, and it will strike the main line between Hydeville and Fair Haven at a point fifteen miles distant from Rutland, making a new piece of road twelve miles long.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WENATCHEE, WASH.—The ranchers across the Columbia River from this city have arranged for the installation of a local telephone system. C.

POLSON, MONT.—A. J. Lowry and others have incorporated the Polson Telephone and Telegraph Company, and construction on the line has been started. C.

AUGUSTA, ME.—The United Service Company, with a capital of $125,000, has been incorporated at Augusta. R. S. Buzzell is president and the treasurer is E. J. Pike, Augusta.

FERGUS FALLS, MINN.—Despite the fact that the city council has refused to grant a franchise to the Northwestern Telephone Company, the company will build a new system in the spring. C.

GASTONIA, N. C.—The Piedmont Telephone Company has purchased the South Point Telephone Company and will reorganize the system of about 100 subscribers. T. L. Allison will be business manager. L.

SALISBURY, N. C.—The Yadkin Valley Telephone Company has just completed a line which will connect the Salisbury Bell Telephone Company patrons with a large part of the rural sections of Davidson County. L.

LAKEVIEW, O.—The Bell Telephone Company was recently granted a franchise by the city council. The request was first denied, but later granted at a special meeting. Work has been started on the new exchange. H.

LAKE CITY, MINN.—The Lake Pepin Telephone Company has been incorporated, with G. Dwelle as secretary and treasurer, to take over the Pepin Telephone Company. Permanent improvements are being considered and the system will be made as perfect as possible. C.

ALBANY, N. Y.—The State Telephone Company has been incorporated with the Secretary of State to operate in New York, Vermont, Massachusetts, Connecticut, Ohio, Pennsylvania and New Jersey, with a capital of $10,000. The incorporators are Harrie McK. Kurtis, L. A. Warren, of Coxackie, and others.

ROCHESTER, N. Y.—The securities of the Rochester Telephone Company have been purchased by the Continental Telephone and Telegraph Company, and the deal provides also for the financing of the Syracuse and Utica independent telephone companies. As the Continental company has a lease of the Buffalo independent line, it will have a through line from Buffalo to Poughkeepsie, New Jersey, Pennsylvania and West Virginia, and will also have lines in Cleveland, St. Louis, Kansas City and other Western points. The line will have no connection with the Bell company.

MIDDLE RIVER, MINN.—A company composed of A. C. Kvennes, Henry Young and others will construct a telephone line to Gatzke. C.

LUVERNE, MINN.—The Luverne Telephone Company has ordered several thousand feet of conduit for underground work in the spring. C.

SPOKANE, WASH.—The Washington Southern Telephone Company, of Spokane, has been incorporated here with a capital stock of $100,000 by C. M. Cooley, L. V. Gray, C. N. Thomas, C. R. Cushman and D. V. Cushman. A.

TOLEDO, O.—At the annual meeting of the Benton Ridge Farmers' Mutual Telephone Company, at Findlay, O., the following officers were elected for the ensuing year: President, W. H. Wittenmeyer; vice-president, D. M. Dreisbach; secretary, J. W. Powell; treasurer, Daniel Jackson.

TOLEDO, O.—The Seneca Telephone Company, recently transferred all of its property to the Old Fort Mutual Telephone Company, at Tiffin, O. It is understood that the transfer is little more than a change of names. N. B. Irwin is president and C. B. Snyder secretary of the new concern. H.

SHERIDAN, WYO.—Telephone communications are open between this place and Salt Lake City, a distance of 833 miles. This line extends for thirty-five miles over the summit of the Big Horn range, reaching an altitude of 9,500 feet, said to be the highest point reached by telephone anywhere. N.

SHOPTON, N. C.—The Steele Creek Telephone Company has been incorporated in Mecklenburg County, at Shopton, by a number of interested farmers, this being in line with a newly waged campaign of the Southern Bell Telephone Company to push rural telephone development. The Bell Company is extensively interested in the operation of these exchanges, a number of which have already been successfully organized. L.

ELECTRICAL SECURITIES.

Since the appearance of the President's message and the consequent quieting of doubts as to his attitude, there has been a marked settling of conditions. In regard to money the outlook is considerably better than it has been for the past few weeks. Appearances are that the Panama loan will soon be made by Secretary McVeagh, and several railway companies are contemplating a new issuance of stock. The present time is, in fact, looked upon by many as the most hopeful period in the past ten years, and certainly all signs favor a resumption of the upward movement in stocks.

Benjamin Strong, Jr., vice-president of the Bankers Trust Company, was elected to the board of directors of the American Light and Traction Company, to succeed the late George P. Sheldon. James M. McCarthy, of Quebec, was elected to the executive committee to succeed Mr. Sheldon.

The recent issue of $2,760,000 Philadelphia Company common stock, which was offered to the stockholders at par, was underwritten by a London syndicate, headed by the Swiss Bankverein, with a view of effecting the introduction of this stock in the London market.

The Chicago & Oak Park Elevated's December earnings showed the first increase as compared with the corresponding period the previous year since 1907. The improvement is ascribed to the abolition of smoking cars.

Te Metropolitan Elevated's daily traffic is running 15,000 ahead of the same period last year.

The gross earnings of the Massachusetts Electric Companies for December showed a gain of $31,000, or six per cent, which compares with a gain of $54,700 in November, an increase of 10.5 per cent, and a 10.3 per cent gain in October. For the first quarter of the current fiscal year beginning October 1, the gross has increased nearly $150,000, or over eight per cent.

Spencer Trask & Company are offering $4,000,000 first mortgage five per cent bonds of the Cleveland Electric Illuminating Company at 103 and interest, yielding about 4.80 per cent. More than three-fourths of the $4,000,000 bonds already have been sold. The property which the new issue covers shows a cost December 31, 1908, of over $8,310,000, or more than twice the outstanding new issue. The capital stock authorized is $6,500,000, of which there is now outstanding $5,364,000, and upon which regular dividends are being paid.

DIVIDENDS.

American Light and Traction Company; regular quarterly dividend of one and one-half per cent on the preferred, two per cent cash and two and one-half per cent stock on the common, payable February 1 to stock of record January 19. Books close January 19 and reopen February 1.

Boston Elevated Railway Company; semiannual dividend of three per cent, payable February 15.

Boston & Northern Street Railway Company; semiannual dividend of three per cent on the preferred stock, payable February 1 to stockholders of record January 15.

Central District and Printing Telegraph Company; quarterly dividend of one and three-fourths per cent, payable January 15. The company heretofore has paid two per cent quarterly.

East St. Louis & Suburban; preferred quarterly dividend of one and one-fourth, payable February 1.

Malden Electric Company; quarterly dividend of two and one-half per cent, payable January 15.

Old Colony Street Railway Company; semiannual dividend of three per cent on the preferred stock, payable February 1 to stockholders of record January 15.

Standard Underground Cable Company; dividend of three per cent, special dividend fourteen per cent, extra dividend of three per cent, and stock dividend of twenty-five per cent, the first three payable January 10.

Twin City Rapid Transit Company; quarterly dividend of one and one-half per cent on the common stock, an increase of quarter of one per cent quarterly.

Union Traction of Indiana two-thirds of one per cent on common, payable January 10.

NEW YORK.

	Jan. 10.	Jan. 3
Allis-Chalmers common	14⅞	14¾
Allis-Chalmers preferred	53⅞	54⅜
Amalgamated Copper	88⅝	90⅜
American Tel. & Cable	*80	*80
American Tel. & Tel.	140¼	141
Brooklyn Rapid Transit	79	79¾
General Electric	159¼	159
Interborough-Metropolitan common	24½	24½
Interborough-Metropolitan preferred	60¼	61½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common.	90¼	90½
Mackay Companies (Postal Telegraph and Cables) preferred	77½	77¼
Manhattan Elevated	136½	137¼
Metropolitan Street Railway	20	20½
New York & New Jersey Telephone	123½	123½
U. S. Steel common	88⅝	90⅞
U. S. Steel preferred	124⅜	125
Western Union	76	77
Westinghouse common	81½	82½
Westinghouse preferred	131½	135

* Last price quoted.

BOSTON.

	Jan. 10	Jan. 3.
American Tel. & Tel.	140¼	141
Edison Elec. Illuminating (all rights)	246	251
General Electric	159¼	159
Massachusetts Electric common	18½	18
Massachusetts Electric preferred	80	78½
New England Telephone	136	137
Western Tel. & Tel. common	17	16
Western Tel. & Tel. preferred	93½	93½

PHILADELPHIA.

	Jan. 10	Jan. 3.
American Railways	49½	46¾
Electric Company of America	12¼	12¼
Electric Storage Battery common	61¼	59½
Electric Storage Battery preferred	61¼	59½
Philadelphia Electric	14⅛	14
Philadelphia Rapid Transit	28	27¼
Philadelphia Traction	88¼	89
Union Traction	52⅝	52

CHICAGO.

	Jan. 10.	Jan. 3.
Chicago Railways, Series 1	108½	108½
Chicago Railways, Series 2	33½	39
Chicago Subway	43½	43¼
Chicago Telephone	135½	134½
Commonwealth Edison	121	119
Metropolitan Elevated common	16½	16½
Metropolitna Elevated preferred	54½	55½
National Carbon common	111	103
National Carbon preferred	120	120

PERSONAL MENTION.

J. V. ZARTMAN has been elected secretary and treasurer of the Indiana Electric Light Association, to fill the vacancy occasioned by the death of Fred Leslie, of Muncie, Ind. Mr. Leslie served as secretary and treasurer of the organization since its inception. His death occurred, after a brief illness, on October 17, 1909.

ALFRED NOBLE, who has been in charge of the East River Division of the Pennsylvania Railroad's New York tunnel extension ever since the work was authorized, severed his connection with the company with the close of 1909. He was a member of the board of engineers appointed by President Cassatt in 1902 to examine the project, pass upon its practicability, and draw up the general plans for carrying it out. Later he was put in immediate charge of the East River Division, extending from the eastern limits of the passenger station to Woodside, L. I., a distance of 4.48 miles, and including Sunnyside Yard, which embraces 153 acres and seventy-three miles of track.

JOHN J. SKINNER, formerly superintendent of the St. Joseph Valley Traction Company, with headquarters at La Grange, has resigned and returned to Peru, Ind. Mr. Skinner has had long service and experience with steam and electric railways and will quit them all to enter the insurance business.

S. E. MULHOLLAND has resigned as assistant manager of the Indiana Lighting Company's property in Ft. Wayne and has accepted of the superintendency of the Murdock traction lines, succeeding Samuel T. Murdock. Mr. Mulholland was formerly superintendent of the Murdock lines and returns to his old position.

IRA BLALOCK, who has been with the Florida East Coast Railway Company for thirteen years as their chief electrician, has recently resigned. Mr. Blalock has accepted a position as chief

engineer and electrical engineer of the Gainesville Gas and Electric Power Company at Gainesville, Fla.

C. H. STENGEL, who was formerly superintendent of coal terminals for the Virginian Railway Company, has resigned his position to accept the presidency of the Electrical Alloy Company, of Morristown, N. J. Mr. Stengel rendered the Virginian Railway very efficient service while with them. He had charge of the coal piers at Sewall's Point, Norfolk, Va., and was also the designer of these piers.

OBITUARY.

CHARLES ALBERT GILL, who was in charge of the Beaver Street office of the Commercial Cable Company, in New York city, for the last six years, died at his home, 261 Greene Avenue, Brooklyn, January 2, from pleurisy. He was secretary of the Official Board of the Summerfield Methodist Episcopal Church in Brooklyn, and treasurer of the Sunday school connected with that church. A widow, a son and a daughter survive him.

JOHN A. J. SHULTZ, president of the Shultz Belting Company, of St. Louis, Missouri, and president of the Missouri Manufacturers' Association, died at his home in St. Louis, on December 24, as the result of a sprain received a short time ago. Mr. Shultz was born in Grantsville, Maryland, on April 27, 1837, and engaged in the tannery business there before coming to St. Louis. He came to St. Louis in 1864 and went in the hide business at the foot of Lucas Avenue. He later engaged in the commission business in addition to hides under the firm name of Shultz & Samples and afterward went into the tannery business as Ford & Shultz. During this time he made the acquaintance of General U. S. Grant, and General Grant's brother, Orville, was in his employ. After the death of Mr. Ford, his partner, he organized the Shultz Belting Company. He was a charter member of the Missouri Society, Sons of the Revolution, a thirty-second degree Scottish Rite Mason, and a member of the Tuscan Lodge. He was filling his second term as president of the Missouri Manufacturers' Association.

GEORGE FRANCIS BROWN, former treasurer of the Pullman Car Company, died on the morning of Sunday, January 9, from an attack of heart disease. Mr. Brown was an old resident of Chicago, and was one of the best-known men in business circles and in the railway world. He was born in Chicago in 1843, and had been in active life in this city from 1871 to 1907, retiring to private life at the later date. He attended school in Chicago, and completed a course at Knox College. In 1861, at the age of eighteen years, he entered the union army as assistant quartermaster to his father, Major S. B. Brown. In 1865, while the war was still in progress, he was married to Miss Catherine Wager, of Philadelphia, Pa. Her death preceded his by eighteen years. After the war, in 1867, he was secretary and treasurer of the receivership of the Memphis, Clarkesville & Louisville Railway, and in 1868 and 1869 he was the Washington representative of the Illinois Central Railway. Mr. Brown returned to Chicago as assistant general superintendent of the Pullman Car Company in 1871. He was later advanced to general superintendent and then to general manager. In 1905 he was elected treasurer of the company, holding office until 1907, when he retired. The funeral was held on Monday afternoon from Christ Reformed Episcopal Church, of which he had been a prominent member for twenty-five years, serving as junior warden and as treasurer of the Chicago Synod. Mr Brown is survived by two sons—George Francis, Jr., and Charles Edward, secretary of the Central Electric Company.

PROPOSALS.

POST OFFICE, EMPORIA, KAN.—Notice has been given by the Supervising Architect that the time for opening bids for the extension, remodeling, etc., of the United States Post Office at Emporia, Kan., has been extended from January 14, 1910, to February 15, 1910.

WIRING FOR HOSPITAL.—The office of Constructing Quartermaster, Washington, D. C. (Takoma Substation), will receive sealed proposals until January 29, 1910, for an extension of the electric lighting system at the Walter Reed Army General Hospital, Washington, D. C. Envelopes containing proposals should be indorsed "Proposals for Extension of Lighting System at Walter Reed Army General Hospital, Washington, D. C.," and addressed to Captain H. L. Pettus, Constructing Quartermaster.

POST OFFICE, MERIDIAN, MISS.—The office of the Supervising Architect, Washington, D. C., will receive bids until February 8, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and standard clock system), of the United States Post Office and Court House at Meridian, Miss., in accordance with the drawings and specification, copies of which may be had from the custodian at Meridian, Miss., or at the Supervising Architect's office.

ELECTRIC WIRING FOR FORT MONROE, VA.—Sealed proposals (in triplicate) will be received until January 26, for the alterations and repairs to old artillery school building at Fort Monroe, Va., consisting of construction repairs, heating, plumbing, and electric wiring and fixtures. Plans for specifications may be seen in the office of chief quartermaster, Department of the East, Governor's Island, N. Y. Deposit of certified check for $25 required as guarantee return of plans and specifications. Bidders on proposal must state the name of manufacturers supplying them material. Information will be sent on application to Ernest R. Tilton, Captain and Quartermaster.

POWER PLANT FOR GOVERNMENT HOSPITAL, WASHINGTON, D. C.—Sealed proposals (in triplicate) will be received at the Department of the Interior, Washington, D. C., until Friday, January 21, 1910, for remodeling the power plant, Government Hospital for the Insane, Washington, D. C., in accordance with the drawings and specifications, copies of which, with form of proposal, may be had on application at the department. Proposals must be marked "Proposals for Remodeling Power Plant, Government Hospital for the Insane." J. E. Wilson, assistant secretary.

ELECTRIC LIGHTING SYSTEM FOR FORT WILLIAM, ME.—Office of Constructing Quartermaster, 655 Congress Street, Portland, Me., will receive sealed proposals (in triplicate) subject to the usual conditions, until January 20, 1910, for the construction and remodeling of an electric lighting system at Fort Williams, Me. A guarantee of ten per cent of bid required. Plans, specifications, etc., are on file in office of the chief quartermaster, Department of the East, Governor's Island, N. Y., and in office of constructing quartermaster, 263 Summer Street, Boston, Mass. Plans, specifications, blank forms for proposals, etc., will be furnished on application. A deposit of $5 required for each set of plans loaned to insure safe return of same. Envelopes containing proposals should be indorsed "Proposals for Electric Lighting System at Fort Williams, Me.," and addressed to Capt. C. F. Humphrey, Jr,. constructing quartermaster, Portland, Me.

NEW INCORPORATIONS.

NEW YORK, N. Y.—The Nelmelior Electrical Company has been incorporated to deal in electrical apparatus and supplies, with a capital of $150,000. The incorporators are: G. Pouzet, O. V. Schrenk, F. F. Kirkpatrick, New York city.

ANDERSON, IND.—The Burk & Durbin Company has incorporated to carry on a general construction business, but will make a specialty of constructing electric railroads and highways. David H. Durbin and Edward Burk are directors of the company. S.

ALLEGANY, N. Y.—The Home Electric Appliance Company has been incorporated to manufacture and sell electrical appliances. The capital of the company is $20,000. The incorporators are: William B. Ensworth and John Laubenthal, Allegany, N. Y.; B. E. Border, Olean, N. Y., and two others.

SPRINGFIELD, ILL.—The American Electric Headlight Company has been incorporated with a capital of $100,000. The company has purchased all of the patents, rights and privileges of the Anderson-Lacey Electric Headlight Company, which was organized under the laws of Texas three years ago with a capital stock of $25,000.

NEW BRITAIN, CT.—The Champlin-Norton Manufacturing Company has been incorporated with a capital of $10,000, for the purpose of manufacturing electrical appliances of which it has the patent rights. The incorporators are: Minton A. Norton, Harvey M. Williams and J. L. Burton of this city, and F. A. Champlin of East Longmeadow, Mass.

CHARLOTTE, N. C.—Application has been made for a charter for the R. G. Auten Electric Company, to succeed the R. G. Auten Company, located at No. 24 West Fifth street. The authorized capital stated is $25,000 with $2,500 required for the beginning of business. Messrs. R. G. Auten, J. R. Winchester and T. A. Adams are the incorporators.

JERSEY CITY—The Glass Telephone Mouthpiece Company has been incorporated for the purpose of manufacturing mouthpieces and other attachments for telephones with a capital of $70,000. The incorporators are: Alexander F. Garbe, No. 400 East 141st Street, Bronx, New York; Cornelius A. Cole, Hackensack, N. J.; Richard F. Tully, No. 15 Exchange Place, Jersey City.

INDUSTRIAL ITEMS.

THE ELECTRIC FIRELESS COOKSTOVE COMPANY, Hastings, Mich., is distributing a folder relating to its electric fireless cookstoves, one of which was described and illustrated in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 25, 1909. The motto, if one may so call it, of this cookstove, is "Cheaper Than Gas," which is the attribute claimed for cooking in an electric fireless cookstove.

THE BLACK & LODER COMPANY, 30 Church Street, New York, N. Y., is distributing a very attractive booklet entitled, "The Development of Profit Factors." This booklet is designed for distribution among central stations and explains in detail the work rendered by the company who are specialists in new business c... paigns, administration policies, organization, construction, ...asing, advertising, accounting, etc.

THE DIELECTRIC COMPANY OF AMERICA, P...ville, N. J., manufacturers of insulated wires and cables for underground transmission is distributing a handsome calendar for the year 1910. It contains a colored reproduction of a painting by William Verplanck Birney entitled "Where the Fox Ran." The painting represents an old English squire and his friends who have just returned from a hunt and are discussing the day's sport, tracing their travels over the fields.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, O., is distributing another of its unique folders containing a message for the purchasing agent. The policy of the Buckeye company is briefly stated and a convincing talk on prices of lamps is given.

THE MINERALLAC ELECTRIC COMPANY, Chicago, Ill., manufacturers of insulating compounds and electrical specialties, is distributing blotters on which it announces the removal of its offices from 839 Monadnock Building to its factory, 1004 West Van Buren Street, Chicago.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., is distributing a folder calling attention to an announcement which appears in the *Iron Trade Review* of January 6. The folder also contains two typical illustrations of electric lifting magnets in action, one handling a 12,000-pound skull cracker ball at the Indiana Steel Plant and the other handling scrap iron weighing 2,000 pounds at Carnegie Steel Works.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has sold to the Virginia and Rainy Lake Company the following equipment for its plant at Virginia, Minn.: Three 500-kilowatt condensing turbines, direct connected, three-phase, 600-volt alternators. A twenty-eight-inch vacuum referred to a thirty-inch mercury column, will be maintained by turbo-jet condensers, one for each unit. A thirty-five-kilowatt, 120-volt induction motor generator set will furnish excitation current for the three units.

THE J. L. MOTT IRON WORKS, of Fifth Avenue and Seventeenth Street, New York, N. Y., has recently issued an extremely attractive catalogue illustrating some of the best and most artistic forms of poles for street lighting. This company has made a specialty of designing poles which harmonize with the architecture of the buildings near which they are placed. A glance at some of the Doric, Ionic and Corinthian lamp columns contained in this publication will convince the reader that art in lamp posts is at last realized.

THE WESTERN ELECTRIC COMPANY, of Chicago, Ill., has recently issued booklets telling of the advantages and uses of the telephone in train dispatching service. "Portable Telephones for Railway Service," describes a line of portable telephones which the Western Electric Company is prepared to furnish for train despatching and railroad construction work. A number of illustrations of portable sets and line poles are given. A little leaflet, "Wise Economies," shows a portable composite set and tells how economies will result from the use of telegraph circuit for telephone service. The Gill Selector for Train Dispatching is illustrated and described in another leaflet.

THOMPSON-LEVERING COMPANY, with offices at 244 Arch Street, Philadelphia, Pa., entered the electrical measuring instrument field the first of the year. The new company proposes to manufacture testing sets, and a full line of electrical measuring instruments, and also to repair instruments of like character. The wide experience of the members of the firm will be at the service of their customers, and they have associated with them the best men in these lines that can be obtained. Mr. Thompson has been for the past few years manager of the electrical department of Queen & Company, Philadelphia. Mr. Levering has been assistant superintendent of the electrical laboratory, and has had seventeen years' experience in high-grade resistance, condenser, and galvanometer work, and is fully experienced in all lines of electrical testing instruments. Mr. Corcoran has been in charge of the galvanometer department for a number of years past, and is one of the best galvanometer men in the United States. The company invites correspondence with everyone interested in the electrical measuring instrument line.

THE WESTERN ELECTRIC COMPANY has just issued Bulletin 1105 describing in minute detail their Intercommunicating Telephone Systems. The bulletin contains forty pages of descriptive matter, showing the different combinations of systems on which the new Western Electric metal intercommunicating telephones may be used. It also contains the wiring diagrams necessary for the installation of these systems. All parts of the instruments are described in detail and well illustrated. The bulletin furnishes valuable information to those who are interested in intercommunicating telephones.

THE LORD ELECTRIC COMPANY, New York, N. Y., manufacturer of electrical specialties, is distributing a number of circulars and folders devoted to its products. Ground plates to be used in connection with lightning arresters are described in one; the M. V. G. cell lightning arrester for alternating-current circuits in another, and the Earl retriever for trolley cars in still another of these publications.

THE INDIANA RUBBER AND INSULATED WIRE COMPANY, Jonesboro, Ind., manufacturer of the well-known Paranite and Peerless rubber-covered wires and cables for inside, aerial, underground and submarine use, has ready for distribution a very attractive calendar for the year 1910, which contains a rubber forest scene on the Amazon River showing natives at work obtaining rubber.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has recently issued a very attractive booklet on "Charging Electrics." Several illustrations show the mercury an rectifier charging outfit in use in a garage. The cleanliness and simplicity of the outfit is shown by the fact that a daintily dressed girl is in each case doing the charging. The company's line of Tungsten Automobile Electric Lamps is well illustrated and described in a booklet on that subject. Bulletin 4708 on the Thomson Direct Current Test Meter shows well how important this meter is to the isolated plant and central station. In bulletin 4702, descriptive of the Chicago and New York fire boats, a number of pictures taken of these boats in operation are shown. The equipment of each is quite fully described and some of remarkable performances related.

DATES AHEAD.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Electrical Contractors' Association of New York State. Next meeting at Utica, N. Y., January 18, 1910.

Wisconsin Electrical Association, Annual Convention, Milwaukee, Wis., January 19 and 20, 1910.

Central Electric Railway Association. Next meeting at Indianapolis, Ind., January 27, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, O., January 31-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) January 4, 1910.

945,011. ELECTRICAL SWITCH. William T. Arndt, Shreveport, La. Filed July 11, 1908. A socket block supports a number of sockets and contains a rotable ratchet wheel for making certain contact combinations.

945,013. ELECTRIC TIME-SWITCH MECHANISM. William C. Blundell, Kansas City, Mo., assignor of one-half to Omar A. Schramm and one-half to Philip C. Schramm, Kansas City, Mo. Filed July 12, 1907. Two levers are devised for automatic operation when unresisted, and are tripped by means of two clocks at predetermined times to operate electric switches.

945,017. FUSE-BOX. Robert C. Cole, West Hartford, Conn., assignor to The Johns-Pratt Company, Hartford, Conn. Filed April 29, 1907. The covered base has line terminals adapted to hold the projecting blades of cartridge fuses, and a pair of fuse-engaging forks on the cover of the base have prongs which straddle the blades and wings on these prongs to engage the fuse body.

945,018. ELECTROMAGNET. Lawrence Connell, Jr., Portland, Ore. Filed July 2, 1906. Renewed May 20, 1909. A high-wound small magnet and a low-wound larger magnet are connected in series and inductively opposed, and a member is operatively associated with and acted upon by the magnets.

945,023. TELEPHONE-TRANSMITTER. Stanley A. Duvall, South Bend, Ind. Filed September 26, 1906. Comprises a diaphragm with a central threaded opening, a bridge carrying a carbon cup, a rear electrode, a mica disk closing the cup, a front electrode connected to the disk, etc.

945,024. APPARATUS FOR RECOVERING MATERIAL FROM SCRAP METAL. Solomon W. Egbert, Joliet, Ill. Filed March 29, 1909. An endless trough conveyor, arranged to support and carry the scrap through an electrolytic bath, acts as the anode.

945,027. ELECTRIC LIQUID-HEATER. Oscar H. Fiddes, San Francisco, Cal. Filed March 6, 1909. A heating coil surrounds an inclined lower pipe connected to an upper liquid container in such a way as to promote circulation.

945,049. ELECTRICAL RECEPTACLE AND MOUNTING THEREFOR. Frank J. Russell, New York, N. Y. Filed May 2, 1908. A clamping device movably mounted on the body is insertible therewith through the recepticle hole.

945,066. SPARKER OR IGNITER. Walter C. Westaway, Beloit, Wis., assignor, to J. W. Duntley, Chicago, Ill. Filed February 1, 1905. Electrodes having flat meeting surfaces contact near the periphery of these surfaces.

945,069. MULTIPLE TELEPHONE-TRANSMITTER. Frank W. Wood, Newport News, Va., assignor to Charles Cory and John M. Cory, New York, N. Y. Filed July 16, 1906. There is a common funnel-shaped mouthpiece for all the transmitters.

945,074. HANGER FOR ELECTRIC FIXTURES AND THE LIKE. Victor Bagley, Topsham, Me. Filed September 28, 1906. The depending fixture rod has a certain amount of play laterally.

945,082. RESISTANCE-GRID. Herbert W. Cheney, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed June 24, 1909. The grid comprises a conductor having end turns each provided with projections between which and insulated from them is located a reinforcing member.

945,092. RESISTANCE-GRID. Bradley Haskins, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed May 20, 1909. The grid comprises a zigzag conductor and a reinforcing member passing around the grid itself and insulated from it.

945,093. MOTOR-CONTROLLER. Clark T. Henderson, Milwaukee, Wis., assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. Filed April 23, 1909. An electroresponsive throttling device has its winding connected in parallel with a predetermined amount of the controller resistance so as to prevent the operation of the automatic resistance-controlling switch when the current through the motor is excessive.

945,103. MOTOR-CONTROL SYSTEM. Charles E. Lord, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed March 30, 1907. Current is supplied to an auxiliary motor (mechanically connected to a generator) when the load on the main motor is excessive.

945,116. RESISTANCE-GRID. Nathan Wilkinson, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed May 20, 1909. Comprises a conductor having end turns provided with slots in which are located insulating members for reinforcing the grid.

945,278. COMBINED SPARK PLUG AND COIL. Edwin S. Lincoln, Brookline, Mass., assignor to Electric Goods Manufacturing Company. Filed May 5, 1908. Interengaging means, secured partly to the coil and partly to the plug, are, in their engaged relation, adapted mechanically to support the coil laterally with respect to the plug, and embody electrical connections whereby the coil may be placed in operative relation with respect to the spark points.

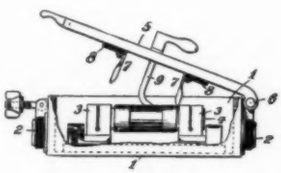
945,293. LIGHTNING-ARRESTER. William C. Shinn, Lincoln, Neb. Filed December 28, 1908. Describes an arrester adapted to connect telephone-line wires to a lightning-rod system.

945,343. VACUUM CLEANING APPARATUS. Charles R. Pollard, Hartford, Conn., assignor to David W. Williams, Glastonbury, Conn. Filed July 24, 1908. Is operated by an electric motor.

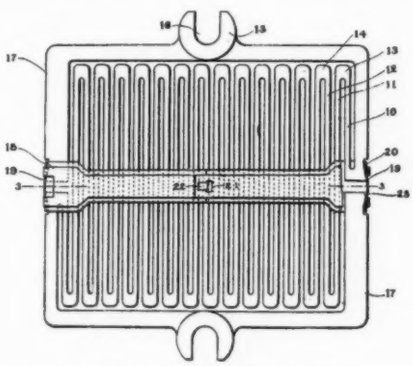
945,350. INSULATOR. Addison B. Tinsley, Ansted, W. Va. Filed May 11, 1909. A retaining element has a polygonal shoulder to register in a seat in the outer face of the inner section of the insulator.

945,374. ELECTRIC BOND FOR RAILWAYS. Harold P. Brown, Montclair, N. J. Filed April 2, 1907. Plugs of readily yielding metal of high electric conductivity are located one each between the respective splice bars and apertures in the under part of the head of the rail so as to be compressed by a wheel in passing along the rail.

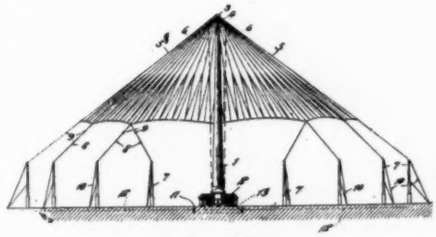
945,397. MECHANICAL CONSTRUCTION OF STORAGE-BATTERY CELLS. Patrick Kennedy, New York, N. Y., assignor to Consolidated Railway Electric Lighting and Equipment Company, New York, N. Y. Filed October 3, 1906. A narrow strip of insulating material extends across the upper edges of the plates and has depending teeth fitting between the plates.



945,017—FUSE BOX.



945,092—RESISTANCE-GRID.



945,475—AERIAL.

945,132. ELECTROLYTIC APPARATUS. Joseph H. Monge and Corrado Arzano, St. Gilles-les-Bruxelle, Belgium. Filed August 27, 1907. The cathode support consists of open-work frames covered with copper blades and cables guided by rollers to lift the cathode support out of or lower it into the bath without disconnecting from the source of current.

945,186. SECONDARY BATTERY. William Morrison, Chicago, Ill. Filed June 8, 1903. Serial No. 160,648. Renewed July 26, 1909. A horizontal position zinc electrode is disposed at or near the bottom of the cell, and a negative element above it is separated therefrom by a separator comprising a series of partitions or cells open at the top and bottom.

945,212. INSULATOR-CLAMP. Jasper Blackburn, Kirkwood, Mo. Filed December 2, 1908. An inverted U-shaped body carries a shank adapted to receive the insulator.

945,213. INSULATOR-CLAMP. Jasper Blackburn, Kirkwood, Mo. Filed January 9, 1909. An insulator support comprises a pin having a plate integral with its lower part and adapted to bear on top of the cross arm, and clamping members, secured to the plate, to engage the sides of the cross arm.

945,236. REGISTERING APPARATUS FOR TABULATING SYSTEMS. Herman Hollerith, Garrett Park, Md., assignor to The Tabulating Machine Company. Filed August 17, 1905. An electric circuit is held under control for a variable period during each cycle of operation, the duration of this period being determined by the location of the index point on the controlling record.

945,243. SECONDARY BATTERY. William Morrison, Chicago, Ill., assignor of one-third to M. A. Lumbard, Des Moines, Iowa. Filed June 20, 1902. Renewed May 22, 1909. The electrolyte is of alkaline zincate and a support is coated with cadmium and mercury, upon which is to be deposited the zinc of the electrolyte.

945,262. IGNITION APPARATUS. Evan D. Bright, Philadelphia, Pa., assignor to The Connecticut Telephone & Electric Company, Incorporated, Meriden, Conn. Filed March 26, 1909. Describes in detail a jump-spark ignition system.

945,398. TRANSMISSION OF POWER FROM A PRIME MOVER TO A LOAD. Arthur C. King, Islington, and Frederick Hamer, Hayes, England. Filed December 19, 1908. Dynamo-electric machines have one structure thereof operated by a main driving motor (as of an automobile) and the other structure connected with the motor-driven shaft through a normally inoperative gear train. Means are provided to energize the second-named structure to cause the gear train to rotate the aforesaid driven shaft.

945,400. CONTACT-SHOE FOR THIRD RAILS. Fred Lacroix, Brooklyn, N. Y., assignor of one-fourth to David S. Greenebaum and one-fourth to Jacob A. Cantor, New York, N. Y. Filed March 13, 1908. A movable mechanism normally holds the contact shoe in an elevated position, and a magnet on this mechanism is adapted to depress the contact shoe.

945,408. MAGNETIC SEPARATOR. Sheldon Norton, Mineville, N. Y. Filed August 1, 1907. The magnets are located within a rotatable drum.

945,425. DYNAMO-ELECTRIC MACHINE. Egbert M. Tingley, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed November 13, 1905. A rotatable member for dynamo-electric machines has a magnetizable core with embedded winding, flanged coupling sleeves clamped to the ends of the core, shaft sections the inner ends of which are seated in these sleeves, and interposed blocks between the ends of the shaft sections and the core.

945,429. AUDIPHONE-RECEIVER. Charles E. Williams, Boston, Mass. Filed January 6, 1908. The insulated case of the instrument is the permanent magnet thereof and have a concavo-convex shape providing a reverberatory chamber about the electromagnet.

945,430. PORTABLE AUDIPHONE-TRANSMITTER. Charles E. Williams, Boston, Mass. Filed January 6, 1908. The case has a narrow neck portion, containing a rheostat, and is curved over on itself.

945,438. AUTOMATIC TELEPHONE PAY-STATION. Francis X. Bee, Philadelphia, Pa. Filed October 29, 1908. Describes in detail the coin-chute apparatus.

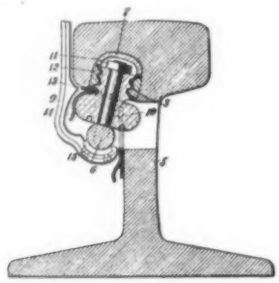
945,440. SYSTEM OF DIRECTED RECEPTION FOR WIRELESS-TELEGRAPHY STATIONS. Ettore Bellini and Alessandro Tosi, Paris, France. Original application filed October 1, 1907. Divided and this application filed June 16, 1908. The receiving station has several dirigible aerials in fixed position, combined with fixed windings inserted in the conducting part of the aerials. Connected to the wave detector is a rotary device influenced by the currents which traverse the fixed windings.

945,448. REFLECTOR AND ATTACHMENT. Henry D'Olier, Jr., Rutherford, N. J. Filed April 15, 1909. Describes a combination of a electric-lamp socket and a vitreous shade or reflector.

945,472. CIRCUIT-CONTROLLING MECHANISM. Charles H. Moores, Oak Park, Ill., assignor to Charles M. Trephagen, Oak Park, Ill. Filed August 13, 1908. Describes a limit-switch mechanism.

945,475. AERIAL FOR THE TRANSMISSION AND RECEPTION OF ELECTROMAGNETIC WAVE ENERGY. Richard Pfund, New York, N. Y. Filed February 10, 1909. The aerial consists of a hollow structure of poorly conducting material with the necessary energizing device located in or around the base. The aerial proper is supported symmetrically from the top of the structure and the earth connections are disposed symmetrically around the base of the structures.

945,480. COMBINATION TELEPHONE INSTRUMENT. Alfred L. Sohm, Whittier, Cal., assignor to National Electric Works, Whittier, Cal. Filed September 4, 1908. The transmitter has a flat face provided with adjustable engaging members. The receiver has a rearwardly extending gripping portion and an outwardly extending flanged open end, the latter being adapted to be arranged between the adjustable engaging members of the transmitter and to be supported by the circuit switch of the instrument.



945,502—ELECTRIC CONDUCTOR FOR RAILWAYS.

945,502. ELECTRIC CONDUCTOR FOR RAILWAYS. Erik W. Enequist, New York, N. Y. Filed October 21, 1907. On the under side of the head of the rail is a longitudinal aperture on one side of the rail web, in which aperture are arranged at intervals composite insulating devices for supporting the conductor.

945,512. FIELD-FIRING OR SURPRISE TARGET. Richard T. Gates, London, England. Filed April 12, 1909. Means actuated by an electrically controlled motor mechanism are provided to cock and release the revolver hammer each time the target is raised.

945,555. PROCESS OF ELECTRIC WELDING. Maurice Lachman, New York, N. Y., assignor to Universal Electric Welding Company, New York, N. Y. Filed March 3, 1908. In the support of one part is formed a continuous groove to reduce the superficial area of such part at the point of the intended weld to form an isolated surface or lug; the butt of the other part is placed on this lug, and current is passed through the parts while pressure is applied to assist in the process of welding.

945,564. STORAGE BATTERY. Paul M. Marko, New York, N. Y. Filed June 10, 1909. A portable storage battery has a voltmeter which can be placed in shunt with it to ascertain the strength of the cell.

945,586. EMERGENCY-VALVE. Oliver Penn, Pittsburg, Pa. Filed September 15, 1909. A gravity-movable weight for the locking means of the spring-actuated mechanism for closing a gate valve, may be disengaged from its holding catch by an electromagnetic device provided with a pivoted armature.

945,614. BATTERY-ELECTRODE SUPPORT. Charles B. Schoenmehl and Wilfred Straw, Waterbury, Conn.; said Straw assignor to said Schoenmehl. Filed April 9, 1909. A top cross-yoke has its outer end portions disposed at an acute angle. A hanger has sides designed to engage the edges of an electrode, and eyes in its upper ends to engage the sides of the yoke. There are means for drawing the eyes inwardly, and the hanger against the edges of an electrode.

945,634. SWITCH MECHANISM FOR ELECTRICAL ALARM APPARATUS. Andrew V. Strait, Sidney, N. Y., assignor of one-fourth to William Bronk and one-fourth to Frank A. Williams, Oneonta, N. Y. Filed February 27, 1909. Circuit-closing devices connect co-operating terminals.

945,644. TRIPPING MECHANISM. Peter Vliet, Canton, Ohio. Filed December 4, 1908. Is electromagnetically actuated.

945,660. ELECTRICAL TROLLEY DEVICE. Lester G. Wilson, Larchmont, N. Y. Filed May 23, 1908. Details are given of a device for permitting a trolley wire to change from one wire to another.

945,671. OIL-SWITCH. Henry P. Ball, New York, N. Y., assignor to General Electric Company. Filed January 19, 1905. An electric switch contact comprises two annular guides; a contact ring consists of a number of laterally yielding contact segments disposed between these guides; and annular channels in the contact ring are engaged by the guides.

945,708. TRICK-TELEPHONE. Erastus De Moulin, Greenville, Ill. Filed December 28, 1908. Mechanism releasable by the movement of a trigger (which may be locked if desired) is designed to startle the person removing the receiver.

945,712. CONICAL PIVOT-BEARING. Albert F. Fletcher, Cleveland, Ohio. Filed November 3, 1908. Describes the details of a conical pivot bearing for a trolley harp.

945,716. MOTOR DEVICE FOR ELECTRIC CLOCKS. Joseph Granz, Chicago, Ill., assignor to Trinity Electric Clock Company, Chicago, Ill. Filed January 22, 1909. Comprises a spring-actuated clock movement, an electromagnet included in a normally open battery circuit, an armature lever actuated in one direction by the magnet, a spring actuating this lever in the opposite direction, a tensioning device (actuated by the armature lever), for the motor spring of the clock movement, also in the battery circuit, and co-operating circuit contact devices carried by the tensioning device and armature lever, respectively.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 10, 1910:

489,481. ELECTRIC RAILWAY TROLLEY. Ernest H. Jenkins, Winfield, Md.

489,505. JOURNAL BEARING FOR DYNAMO ELECTRIC MACHINES. Wm. L. Silvey, Lima, Ohio.

489,526. ELECTRIC LIGHTING SYSTEM. Harry M. Doubleday, Pittsburg, Pa.

489,551. ELECTRICAL DIAPHRAGM. Chas. N. Waite, Newton, Mass.

489,553. ELECTRICAL SWITCH. Geo. Baehr, Brooklyn, N. Y.

489,559. GALVANIC BATTERY. Geo. L. Foote, Brooklyn, N. Y.

489,563. ELECTRIC RAILWAY. Daniel E. Kimball, Topeka, Kans.

489,571. SPRING JACK SWITCH FOR TELEPHONE EXCHANGES. Chas. E. Scribner, Chicago, Ill.

489,570. SPRING JACK SWITCH FOR TELEPHONE EXCHANGES. Chas. E. Scribner and Wm. E. Patterson, Chicago, Ill.

489,573. CONDUCTOR SYSTEM FOR ELECTRIC RAILWAYS. Geo. W. von Siemens, Berlin, Germany.

489,597. MULTIPHASE RAILWAY SYSTEM. Francis B. Badt, Chicago, Ill.

489,598. ELECTRIC LIGHTING SYSTEM. Francis B. Badt, Chicago, Ill.

489,603. ATTACHMENT FOR TELEPHONES. Jas. L. Davidson, Pittsburg, Pa.

489,616. ELECTRIC GAS LIGHTING APPARATUS. Aaron M. Sloss, Kansas City, Mo.

489,625. ELECTRICALLY CONTROLLED VENTILATOR. Sebastian G. Brinkman, New York, N. Y.

489,629. RAILWAY SIGNAL. Wm. F. Z. Desant, New York, N. Y.

489,653 ELECTRIC GAS LIGHTER. Thomas W. Lane, Boston, Mass.

489,668. ELECTRIC BATTERY. Clarence H. Bryan, Chicago, Ill.

489,682. LAMP SOCKET. Amandus Metzger, Schenectady, N. Y.

489,687. MEANS FOR CONTROLLING ELECTRIC MOTORS. John F. Ott and Arthur E. Kennelly, Orange, N. J.

489,709. VARIABLE SPEED ELECTRIC MOTOR. Carl Hering, Philadelphia, Pa.

489,736. RAILWAY SIGNAL. John E. Geary, Syracuse, N. Y.

489,739. SOCKET SWITCH FOR INCANDESCENT ELECTRIC LAMPS. Louis Henry and Louis N. Dalysson, Newark, N. J.

489,764. UNDERGROUND ELECTRIC RAILWAY. Jas. B. Sheldon, Daniel J. Murnane, and Geo. L. Van Beek, St. Louis, Mo.

489,815. HANGER FOR ELECTRIC LAMPS. Chas. S. Hume, Detroit, Minn.

489,832. GALVANIC BATTERY. Wm. R. Reud, New York, N. Y.

489,835. CLOSED CONDUIT ELECTRIC RAILWAY. Chas. A. Stark, Duluth, Minn.

489,861. BRACKET FOR ELECTRIC LIGHT WIRES. Geo. H. Bennett, Cincinnati, Ohio

489,883. ELECTRIC CAR TRUCK. Thomas Tripp, Avon, Mass.